THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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(J. A. BERLY'S).

1911 EDITION

NOW IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

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"THE" INSTITUTION.

THE new session of the Institution of Electrical Engineers has commenced under most favourable auspices. The members are to be congratulated upon the attainment of their ambition to possess a building of their very own, where they can feel, and be, at home—a craving innate in every Briton. They are no longer obliged to accept the hospitality so generously afforded by the senior institution, to which they are so greatly indebted; on the contrary, they are now in a position to offer hospitality to associations less fortunate than themselves, and will probably find ample opportunity to indulge in that luxury. The inauguration of the new headquarters is therefore an occasion of rejoicing also to the latter, who will no doubt find the facilities and accommodation thus thrown open to them all that they could wish for. The splendid library offers unrivalled resources to those in search of information on all things electrical; the common room provides for meditation, conversation and other amenities; the courteous office staff are always at hand, ready and willing to furnish information as to when subscriptions are due; and in the lecture theatre they may be charmed with the eloquence of a Thompson, fascinated by the demonstrations of a Duddell, or diverted with the wit of a Swinburne, while awaiting their opportunity to add ten minutes' wisdom to the lore stored up in the Institution's archives. Whether, in the future, they will be enabled to satisfy the needs of the inner man without crossing Savoy Hill is a question that for the present rests on the knees of the gods—*i.e.*, the Council; the time is not yet. They also may taste the pleasant sensation of being landlords to no mean tenants. All these and other advantages are now theirs to enjoy; and we tender our hearty and sincere congratulations to them, including ourselves also.

The credit for this happy consummation belongs to the Council; it may be somewhat invidious to mention names, but, at any rate, we may refer to the labours of Mr. W. M. Mordey, to whom, we believe, when President-elect, the inception of the project was due, and by whom, as Chairman of the Building Committee, during and after his year of office as President, the scheme of reconstruction was developed and carried through. To Mr. Ferranti has fallen the pleasure of presiding at the first ordinary general meeting in the new theatre, and while offering him our felicitations, we would take the opportunity also of congratulating the Institution upon its choice. The name of Ferranti stands for all that is upright, true and straightforward in engineering; for genius which perhaps was in advance of its time, but nevertheless has made an indelible record in the history of electrical engineering; and for enterprise and sound judgment which time has proved to have been entirely on right lines. From time to time—at rare intervals—Nature produces an engineer who, like the poet, is born, not made; of such were Watt, Stephenson and Kelvin, and such is Ferranti. Still in the prime of life, his work is far from finished, and we feel that in wishing him long years of health and prosperity, we voice the sentiments of all our readers.

In his inaugural address Mr. Ferranti strikes out on bold and original lines, dealing in the broadest way with the conservation of the natural resources of these islands. We regret that the exigencies of time and printing compel us to go to press before it is delivered, and as it is a point of honour not to anticipate the President's personal delivery of the address, the possibility that through some mischance it might be postponed, forbids its publication in this issue We may, however, express our appreciation of the courage with which the President has attacked a problem of vast

magnitude and importance, and of the ingenuity with which he has dovetailed together such apparently incompatible subjects as the utilisation of coal, development of agriculture and improvement of the conditions of labour, while at the same time foreshadowing an era of prosperity and progress, with electricity available everywhere at an average price of ½d. per unit. Even the weather comes within the purview of the address, as well as the roads, and the effect of labour-saving methods on the standard of living; in the last-named connection the President, like the President of the Institution of Civil Engineers, points out the ultimate benefit derived by the workman from a reduction of the amount of labour required in any process.

No doubt, as the author admits, his schemes are far in advance of present knowledge and means, and many changes must be made in social and industrial conditions before they can be carried out in their entirety; but the rate of progress is now rapid, and we have already seen vast changes and inventions approaching the miraculous. We, therefore, welcome this inspiring address as setting a mark at which to aim, and we trust that its author may live to see his proposals brought to fruition.

Practical Education.

In his inaugural address to the Newcastle Section of the I.E.E. on Monday last week, Mr. C. Faraday Proctor discussed the methods of teaching in vogue in our elementary schools, and deplored their inefficiency, advocating the adoption of practical instruction as opposed to book learning. We must confess that we have experienced considerable difficulty in grasping Mr. Proctor's views, as his address is the reverse of lucid, and he discusses the training of an engineer with first-class honours in the same breath as that of a school-girl. However, so far as we can make out, he is in favour of a larger proportion of manual training and cultivation of the intellect by affording ample opportunity for the storing of mental pictures or impressions derived from observation. These views will meet with little opposition.

We are, however, unable to agree with what we take to be Mr. Proctor's opinions regarding the employment of highly-trained technical men in factories. His frequent references to "the practical and theoretical sections of a works" appear to indicate a subdivision of the staff under these headings, and this inference is strengthened by his appeal for closer co-operation between "the practical and theoretical departments" and the commercial department. To the lack of close touch between these sections he attributes great loss of efficiency.

There ought to be no such subdivision. What, indeed, is a "theoretical department," anyhow? Is it a department which has a "theoretical" existence? or a department which theorises? Or is it a research department? The last-named is of undoubted value, but we do not think that is what Mr. Proctor means.

Apparently he has experienced the difficulty of securing harmonious working between a so-called "practical man," who looks with contempt on what he calls "theory," and a highly-trained engineer or chemist, whose efforts to introduce scientific methods do not meet with the approval of his old-fashioned colleague. Our sympathies are entirely with the trained man.

There should be no division into "practical" and "theoretical" departments; they should be fused into one, for the men employed in the supervision of the working processes should themselves be scientifically trained.

The old-fashioned rule-of-thumb man should have no place in a modern works—no place of authority, at any rate. He is most conservative in his views, for he dare not venture from the beaten track with which he is familiar; he is lethargic in disposition—otherwise he would not remain ignorant of modern scientific methods; and knowing that his position is precarious, he is jealous of interference with his duties. Hence progress and enterprise are barred by his presence, and sooner or later he must give place to the better qualified man—otherwise the shutters must go up. We believe that Mr. Proctor's ideas regarding the training of a modern technical student are mistaken; he may have met with examples of the kind he suggests—if so, it speaks ill for the college whence they come—but the product of any of our leading technical colleges and engineering universities is a man of a different stamp—a man not "theoretically trained," to quote Mr. Proctor's phrase, but scientifically trained—and if we have understood his rather incoherent paragraphs aright, we are bound to disagree with him.

October Foreign Trade.

The figures for our foreign trade during the month of October show continued improvement all round. The imports advanced by nearly 5½ millions sterling, nearly two-thirds of the increase representing raw materials; the exports improved by 3¾ millions sterling, 3¼ millions being manufactured goods, and the re-exports by nearly £400,000. The exports of electrical goods and apparatus, other than machinery and telegraph and telephone wire, advanced by £72,749, and machinery was better by £108,906 than for the corresponding period of last year. For the 10 months the increase in electrical goods and apparatus exported is given as £1,522,050.

The Price of Niagara Power in Canada.

From time to time we have noted the progress of the extensive electrical distribution scheme which is being carried out in South-Western Ontario by the Ontario Hydro-Electric Power Commission. The Commission, it will be remembered, entered into a contract with the Ontario Power Co. to purchase not less than 8,000 H.P., and as much more as it requires up to 100,000 H.P., for a term of 10 years (with the provision for three extensions of additional 10-year periods) at $9·40 per H.P. per annum, up to 25,000 H.P. and $9 per H.P. per annum if the latter amount is exceeded. The power is delivered at Niagara Falls at 12,000 volts pressure, and there stepped up to 110,000 volts for transmission over 300 miles of line to local transformer stations, where the pressure is reduced to 13,000 volts for the supply of local feeders. A map showing the scope of the undertaking, with details of the technical work appeared in our issue of Sept. 24th, 1909.

According to the *Canadian Engineer*, the present arrangement of the Commission include the supply of 34 municipal corporations on the following basis:—

1. The contract price of the Ontario Power Co. at Niagara Falls, plus
2. Four per cent. per annum upon that part of the construction cost which is properly applicable to each participating municipality, plus
3. An annual amount sufficient to create a sinking fund which in 30 years shall completely pay for that portion of the cost of construction which is applicable to each municipality, plus
4. That portion of the line loss and general operating and maintenance charges which is properly applicable to each municipality.

This works out in practice at from $17·50 to $26·50 per H.P. per annum in the case of a dozen municipalities—Toronto, for instance, paying $18·10 per H.P. per annum.

Our contemporary gives the following particulars as to the progress of the work:—"The sub-stations are practically all completed, so far as the buildings are concerned; over two-thirds of the transmission towers are erected, and the balance will be erected within about a month. The electrical equipment construction is completed and installed, and all municipal distributing plants are under construction or arranged for. Meetings of the municipal engineers concerned have been held at frequent intervals with the object of standardising all possible features of the undertaking. The total estimated cost of the finished project was $3,500,000, and the actual cost, as determined by the contracts let, comes well within that figure."

In connection with this scheme, the civic authorities of Berlin, Ont., held a celebration during the week ending October 15th, of the turning on of Niagara Power. It is considered that this power development will enable manufacturers along the transmission route to compete with the most favoured concerns situated close to the Falls, as the slightly higher cost of electrical energy is more than counterbalanced by the superior transport and labour conditions inland.

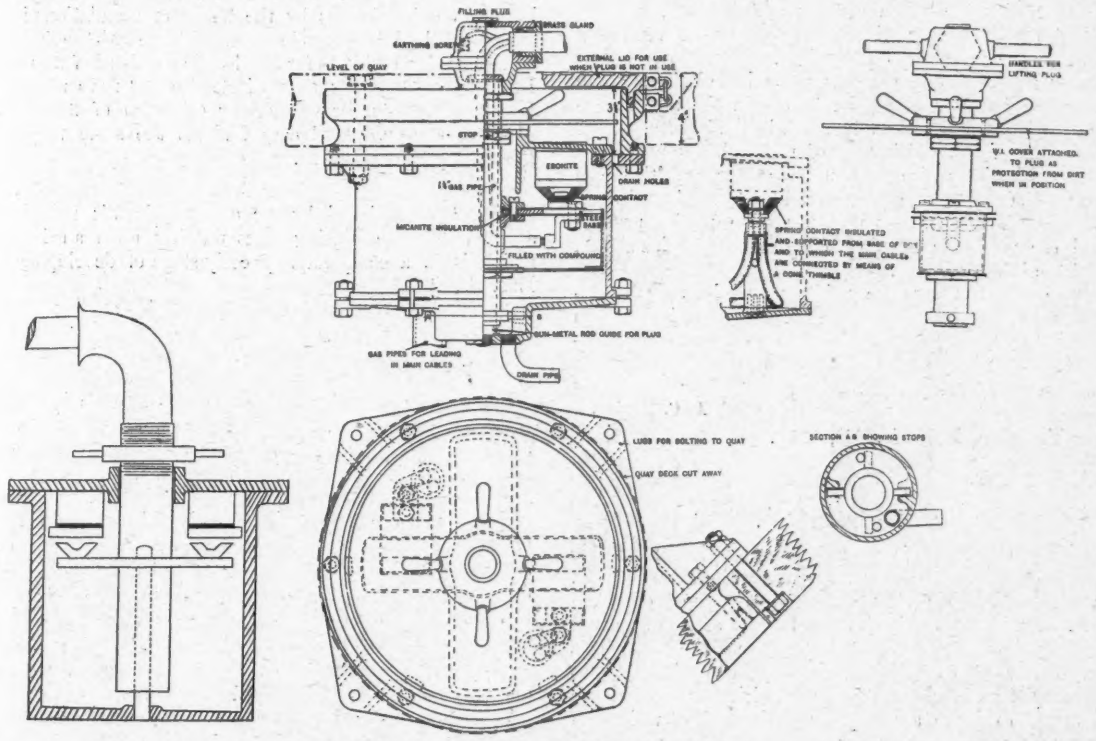
A DESIGN FOR A PLUG CONNECTOR.

By C. TURNBULL, M.I.E.E., North Shields.

Designs were recently obtained by me for a plug connector to carry 100 amperes at about 500 volts, which was to be fixed in the wood deck of a fish quay, under which was sea water. The quay at times is washed down with salt water, and also becomes littered with the usual stuff pertaining to such localities. Many standard designs were carefully examined, but all seemed unsuitable for the work. Generally speaking, the plug was arranged with pins which fitted into sockets in the base. Should salt water get into such a plug, it would short circuit the live parts, while a film of salt would be liable to form between the contacts and destroy the copper, as is well known to those who have to deal with electrical apparatus in exposed places. Moreover, the plug designs were so inaccessible that repairs would be troublesome and costly. There was the further difficulty that if the lid were left off at any time, the live metal would be exposed to the street boys who frequent such places, and being of an inquiring turn of mind, the lads would rejoice to push lumps of metal into the plug as soon as the attendant turned his back. This might not happen often, but once in five years or so would be quite enough. One maker proposed to secure the plug base horizontally under the deck, getting to it through a hole in the deck. This would have made the base still more inaccessible for repairs, while the plug would have been pulled out of the socket with the slightest strain on the cable. Indeed, in many plugs, the whole pull of the cable came on the pins, which were mechanically insufficient for this purpose. The pin design also gave a bad lead for the connecting cable.

Eventually the design shown in the figures was got out. No doubt makers consider one a terrible faddist when standard designs are not accepted, but one must be willing to put up with this allegation. Accessibility forms the fundamental part of the design, in which the fixed contacts are under the plug box lid, and can be got at by taking the lid off. The main cables are not connected directly to the fixed contacts, but through brush contacts, so that the lid may be taken off or replaced at will, which greatly simplifies the overhaul of the box. To connect up, the plug is put through a slot in the box lid, then turned round and drawn up against the contacts by a nut on the shank. The left-hand figure shows the general idea, while the other figures show the working details. The plug connector is steadied by a steady pin, and stops are provided to ensure that it is turned round the right amount. Brass is used to a considerable extent for screws, &c., which have to be taken out for overhauling, to prevent rusting up.

While it is not pretended that this design is anything like perfect, still it is an attempt to solve a problem, and it may be of interest to others. Perhaps some of your readers may be willing to criticise the details.


FILLING PLUG
BRASS GLAND
EARTHING SCREW
LEVEL OF QUAY
EXTERNAL LID FOR USE WHEN PLUG IS NOT IN USE
STOP
EBONITE
DRAIN HOLES
CONTACT
MICANITE INSULATION
FILLED WITH COMPOUND
GUN-METAL ROD GUIDE FOR PLUG
GAS PIPES FOR LEADING IN MAIN CABLES
DRAIN PIPE
HANDLES FOR LIFTING PLUG
W.I. COVER ATTACHED TO PLUG AS PROTECTION FROM DIRT WHEN IN POSITION
SPRING CONTACT INSULATED AND SUPPORTED FROM BASE OF BOX AND TO WHICH THE MAIN CABLES ARE CONNECTED BY MEANS OF A COPPER THIMBLE
LUGS FOR BOLTING TO QUAY
QUAY DECK CUT AWAY
SECTION A B SHOWING STOPS

Sketch and Details of Plug Connector.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Municipal Trading.

My correspondence under the above heading seems to have stirred many forces—some even going away from the points under discussion to inquire into my personal affairs. The remarks of a "Birmingham Contractor" appear to show that I assume there is always discontent between municipal officers and contractors; this, of course, is not so. As a proof, however, of the incompetency of local contractors, it may be stated that complaints of excessive cost of lighting are practically always due to bad wiring arrangements and badly designed installations, for which the contractor is responsible. Alterations suggested by the Consumers' Department assistant always result in improved and satisfactory service, hence a happy consumer, a good recommendation, and prospects of more business. The competent contractor should recognise that criticism is levelled at incompetence, and not at contracting as a business. We find that the most severe criticism of this incompetence comes, and rightly so, from the proficient contractor.

Your leaderette on "Contractors' Grievances" contains an admission from the Association "that in certain districts from 50 per cent. to 75 per cent. of jobs will not comply

with any effective wiring rules." No stronger condemnation could be given; and coming as it does from the Contractors' Association, it is an admission of the truth of my criticisms. Mr. Duncan Watson's letter I would gladly ignore, but may remind him that it is a further proof of the established fact that the introduction of personalities shows a weak case, and is usually the last method of the attack of a bad attorney, and also an admission of defeat.

I might point out to Mr. Thompson that the curtailment of expenses of a consumers' department would not relieve rates. The cost of these departments rarely exceeds 1 per cent. or 2 per cent. of the total revenue, and it will be admitted that such a reduction would not stimulate growth of business as do the energies of a well organised department. If a man cannot get lighting business with metallic-filament lamps and current at 3½d. per unit, he's not much good.

In preceding years the electric supply authorities have catered for the larger and wealthier shops and dwelling houses by running mains in these districts, with the result that now most of this class of consumer is taking a supply. In doing this they have almost neglected the middle and poorer class districts, which, in reality, are much more profitable consumers. They are always at home, the shops are kept open a longer number of hours in the evening, and a greater number of consumers can be obtained per mile run of cable. It is, therefore, to this class of consumer that supply authorities must look to increase business. It is useless hoping for any co-operation from contractors; they view each other with too much distrust and jealousy, and are usually too busy pushing private plant and expensive fittings to even co-operate amongst themselves.

Supply authorities in previous years have been seriously handicapped in their enterprise to obtain the above consumers by having no powers to assist in the internal wiring of such places. The hiring-out of motors has proved to be a profitable business with many undertakings, and therefore why cannot wiring be so, on the same lines? Again, it is only sound reasoning to suggest that the same methods which control the profitable running of distributing mains should control the interior wiring.

I have tried to reason the points raised by your correspondents in plain language, and, personally, feel that this wiring question will in the future have to be attacked most seriously to develop the use of electricity, especially amongst the middle and poorer classes.

A. C. Bostel.

Acock's Green, *November 4th*, 1910.

Careless Reviewing.

I trust you will permit me to express my thanks for your remarks, in your issue of October 21st, under the above heading, on a contemporary's review of my recent work on electrical theory. As letters received from leaders of scientific and philosophical thought appear to indicate that the book meets a recognised want, I may perhaps be allowed to point out that the history of its development is entirely inconsistent with the "labouring to prove a preconceived theory" of which the reviewer supposed it to show evidence. It was designed expressly to meet the requirements of engineers and other physical students to whom the intricacies of modern mathematical analysis would offer an insurmountable obstacle, but who need, nevertheless, more than a popularly written treatise in which the inherent difficulties of the subject are avoided by the simple process of omitting all reference to them. None of these difficulties have been passed over in this manner, but they have been presented, as completely as possible from the physical standpoint, with the aid only of the simple mathematics with which every physical student may be expected to be familiar, and, where further mathematical development appeared advisable, it has been relegated to appendices.

Electrical theory covers so wide a field at the present time that the inclusion of gravitational theory and the problems of stellar systems, although not originally contemplated, was a natural and necessary development. Some of the matters so included are of such wide and general interest that some of the introductory chapters are largely re-written and further simplified to make them accessible to the cultured general reader as well as to the student. The fundamentally important consequence of Jeans's investigations in the dynamics of matter and ether, that a universe containing molecular matter can only form an eternally stable system under the control of guiding intelligence, led to the investigation of the concluding chapter, in which I have endeavoured to determine by purely physical reasoning founded on observation, the powers of this primal intelligence as far as physical observation and argument are capable of revealing them.

The attempt to extend the physical argument by purely philosophical considerations, to which the reviewer takes such objection, as lessening the value and adding enormously to the length of the volume, occupies half-a-dozen pages at the end of the final chapter. This chapter, when first sent to the publishers, contained only some materials for the physical argument afterwards developed. It was recalled and rewritten, while the earlier chapters were going through the Press. The philosophical argument at the end of the chapter was arrived at much later, after the first proof of the rest of the chapter had been received.

G. W. de Tunzelmann.

November 1st, 1910.

Excessive Taxation.

May I call your kind attention to the injustice which is imposed on electric cars by the Treasury Regulations in the Finance Bill. I have been in correspondence with the Treasury, and they inform me that for my electric runabout of 2 to 4 H.P. I must pay £4 4s. per annum instead of £2 2s., as formerly. I thus pay £4 4s. for a motor-car (electric) of 2 to 4 H.P., whilst a 6½-H.P. petrol car, of about the same weight on the road, pays only £2 2s.

Beta.

[The tax mentioned by our correspondent is undoubtedly a gross injustice, bearing most unfairly upon an industry which is in a comparatively early stage of development.—Eds. E.R.]

Post Office Telegraph and Telephone Finance.

That tardy annual, the Postmaster-General's Report on the Post Office, for the year ending March 31st, has just made its appearance. A few years ago it was available in August, but it is gradually becoming a Christmas publication.

In view of the approaching creation of an exclusive Post Office monopoly in the telephone, the financial results of the present telegraph and telephone work of the Post Office are of interest to business men and political economists. Summarised they are as follows:—

	Capital Expenditure.	*Gross Revenue.*	*Working Expenses.*
Telegraphs ...	£18,523,019	£3,166,192	£3,568,203
Telephones ...	10,138,128	1,391,377	1,026,933
Total ...	£28,661,147	£4,557,569	£4,595,136

The excess of expenditure over revenue for the year was therefore £37,567.

The working expenditure of the telegraphs was 113 per cent. of the gross revenue. The working expenditure of the telephones was 73·8 per cent. of the gross revenue. The working expenditure of the combined undertakings was just over 100 per cent. of the gross revenue.

All capital charges, on 28½ millions of capital, have to be met from other sources than the earnings of the combined undertakings.

Interest on the original capital of the telegraphs, £10,800,000, is paid out of the consolidated fund. On the capital added since the purchase capital account was closed, many years ago, no interest is paid.

Interest and sinking fund on telephone capital is paid partly by net telephone revenue and partly by royalties from licensees; the royalties for the past year amounted to £320,590, or almost as much as the net revenue of the whole telephone business of the Post Office.

The actual net telephone revenue, arising from the trunk line system, the London system and the provincial systems of the Post Office, amounted to £364,444, or 3·55 per cent. on the total telephone capital of £10,138,128. The amount required for interest and sinking fund on telephone capital was £767,007, so the net telephone revenue failed to meet capital charges for the year by £402,563.

It is to a department which produces from a technical industry financial results such as these that the political authorities now propose to entrust the entire telephone business of the country.

Herbert Laws Webb.

London, S.W., *November 4th*, 1910.

Lightning Conductors.

I, for one, should be very pleased to join "W. H. B.'s" informal discussion either at the Institution of Electrical Engineers (of which I was elected a member last May), or at his "cosy place." I have already discussed some points in connection with the subject with Mr. Killingworth Hedges in private and public, as well as meeting him with the pen in the columns of electrical papers, and should be quite willing to meet him again in either way at any time. But I doubt whether such a meeting, even if it could be arranged, would prove satisfactory. A debate of this kind is apt to degenerate into a series of point-to-point races without finishes. Even if this did not happen, the discussion of a few isolated points, that make usually very little difference one way or the other, is calculated to do more harm than good, because it attaches to them a false idea of importance and clouds the true issue.

It is an unfortunate thing for the subject of protection from lightning that, during the past 10 years or so, engineering details have been given undue prominence to, and the scientific aspects—on which the whole question of efficacy depends—have, in consequence, been shelved and ignored to a very great extent. Some of these engineering details are of importance as regards durability of the conductor, but of what advantage is durability if the system is inefficient in the first instance? The question of iron *versus* copper is an example. From the way this is put sometimes, one might think that a copper conductor would fail and an iron one prove efficient, or *vice versâ*, under precisely similar conditions, whereas it is merely a question of durability and cost—a copper installation being, as a rule, cheaper than an iron one.

Discussion of a subject does no harm, I think; it lets in a lot of light, and if, sometimes, a little unnecessary heat accompanies it, fatal results are not likely to follow. If any real good is to come of a discussion, it would be more likely to result from the adoption of "A. W. P.'s" suggestion; but if I were bringing the matter forward in a lecture for discussion, I should not be content to deal only with the points that some appear to think of primary interest. I should want to deal first with the really important aspects of the matter. It would then probably resemble lectures I have delivered before the Fire Congress (Electrical Section), Royal Engineers, and several architectural societies, and that have been published. The points that appear to be regarded as especially requiring light thrown on them would be introduced as questions of academic rather than practical importance.

The covering of so much ground would, however, mean either one very long lecture or two shorter ones, and I doubt whether the matter would be of sufficient interest to electrical engineers to induce them to attend and join in the discussion. But if the opinions that a rather long practical connection with the subject, as well as a close study of it, have led me to form, are wanted, they are at the disposal of electricians, either publicly or privately.

Alfred Hands.

London, E.C., *November 8th*, 1910.

"Constant Reader" who asks for information about Hong Kong—he wants to know something about the conditions of living, climate, &c., and to get into communication with someone who has been there—has omitted to send us his name and address.—Eds. E.R.

LEGAL.

Gill *v.* J. Stone & Co., Ltd.

In the Chancery Division of the High Courts, before Mr. Justice Swinfen Eady, on Friday, November 4th, this action was commenced by Mr. Arthur Bernard Gill, electrical engineer, the inventor of a system by which railway carriages are lit with electricity, against J. Stone & Co., Ltd., electrical engineers of Deptford, and manufacturers of the above system.

Mr. Walter, K.C., with Mr. Colefax, M.P., and Mr. F. H. Moulton, appeared for the plaintiff, and Mr. Bousfield, K.C., Mr. Astbury, K.C., Mr. Swinney and Mr. E. Bousfield were counsel for the defence.

Mr. Walter, in the course of a lengthy opening, said the action was brought to determine the rights of the parties in agreements relating to the above invention. In the year 1893 the defendant firm, who were then carrying on business as iron and brass founders and engineers, were minded to enter into a branch business as electrical engineers. About this time they came into contact with the plaintiff, who had devoted his knowledge and energies to the lighting of railway trains with electricity. On June 24th, 1893, the parties entered into an agreement under which plaintiff was appointed manager of defendants' electrical business at a salary of 100 guineas per annum for a period of seven years, together with commission. The agreement was terminable in the event of plaintiff's non-compliance with his duties as manager, and also if the turnover should not exceed the sum of £3,000 in a year. The agreement further provided in respect of Mr. Gill's position as inventor, that plaintiff should use his best endeavours in the matter of inventing and discovering improvements in electrical appliances, designs, &c., Messrs. Stone & Co. to be the sole manufacturers, and plaintiff to be paid a royalty of 10 per cent. on the sales. The parties remained on this footing until May 20th, 1896, and during that time Mr. Gill took out three patents relating to the lighting of trains by electricity. On May 26th, 1896, another agreement was entered into, supplementary to the original agreement and altering Mr. Gill's salary to £500, which was intended to cover the commission hitherto allowed. It also gave Messrs. Stone liberty to assign or grant such patent rights or licences in respect of any of Mr. Gill's inventions on condition that they paid to Mr. Gill one-sixth part of their net receipts in respect of any such assignment or grant. The business, continued Counsel, became enormously profitable, the turn-over reaching to over a quarter of a million. The parties continued to work under this agreement until May, 1900, Mr. Gill having taken out another patent in respect of his lighting apparatus, and the royalties being paid at the agreed rate of 10 per cent. to plaintiff. In May, 1900, however, still another agreement was entered into, renewing the previous agreements for three years certain from January 1st, 1900, and thereafter until determined by either of the parties. It also altered the payments in royalties to be made to plaintiff, to the effect that he should receive a royalty of 10 per cent. on the actual prices received by Messrs. Stone & Co. for all fittings and apparatus supplied by them to any railway coach fitted with the lighting apparatus invented by Gill. This agreement, among other provisos, contained a clause to the effect that in the event of an assignment or transfer to a public company (with limited liability) of the patent rights mentioned in the agreements, and of their business of electrically lighting railway coaches, either party might determine Mr. Gill's appointment as manager upon six months' notice being given on either side in writing prior to the assignment. Shortly before May, 1904, a limited company called J. Stone & Co., Ltd., was incorporated and took over the whole of Messrs. Stone's business, including the electrical branch. Matters went on just the same under the new company, Mr. Gill continuing to act as manager and to receive royalties under the agreement for his patents. In 1906, however, difficulties began to arise, and Mr. Gill had several discussions with the directors, complaining that he was interfered with in his capacity as manager, and that if he could he would resign his position. Matters, however, were smoothed over until 1908, when there was further friction. At this time plaintiff was drawing over £20,000 a year in royalties. In fact, approximately the whole of the railways in the United Kingdom, and in the larger part of the world, had electrically lit their trains with the plaintiff's system. Considerable interference, plaintiff alleged, having taken place in 1908, he decided to give up his position as manager to the defendants' electrical business. He gave six months' notice, and eventually his resignation took effect. After this, trouble began to arise over the payment of the royalties to plaintiff, and so the writ was issued in the present action. Defendants now claimed that the royalty payable by them was payable upon some other basis, and was to be determined by Clause 8 of the first agreement, which said that plaintiff should use his best endeavours to invent and discover improvements in electrical fittings, designs, modes of fittings, &c., and any discoveries made by him were to be communicated to the firm, who were to have the sole right to manufacture and sell the subject of any such invention on the terms of paying plaintiff a royalty of 10 per cent. on the same. Since the issue of the writ, defendants had prepared and shown to plaintiff what purported to be a statement of royalties due to him, but plaintiff said that such royalties were arrived at by a division of the selling price between parts of the apparatus, on some of which defendants admitted royalty was payable, and on others of which they alleged no royalty was payable. Defendants were not entitled to make such a division, or so determine the royalties. He asked the Court for a declaration as to the apparatus, and parts of apparatus, on which he was entitled to receive royalties and the

principle upon which they should be calculated. He also claimed that defendants were not entitled to license any person or company to use any of the said patented inventions without his consent, and that he was entitled to royalty on all work carried out by persons or companies so purported to be licensed, as if the defendants had done the work themselves. Also he asked for an inquiry and account. Defendants declared that plaintiff had not used his best endeavours as their manager; and they counterclaimed a declaration that the agreements between plaintiff and themselves were duly determined by his notice of resignation. That they were entitled to grant licences as from December 3rd, 1908, without plaintiff's consent; that he was only entitled to receive 10 per cent. of the moneys actually received by defendants as royalties under licences granted subsequent to December 3rd, 1908, and among other declarations that their account of royalties due to plaintiff was correct.

His Lordship: If it is proved that plaintiff is entitled to one-sixth of the net receipts upon the assignment of the business to the limited company, that would be your whole case.

Mr. Walter said that was so, but if he did not prove his title to one-sixth, then the question to be determined was the true construction of Clause 8 and the whole position of plaintiff in respect of the royalties due to him.

Proceeding, counsel explained how defendants, instead of making up plaintiff's royalty account on the whole of the apparatus, had taken only inconsiderable parts of the apparatus, and had reckoned plaintiff's percentage upon those, so that instead of working out at thousands, as had hitherto been the case, his royalties had been whittled down to a few hundreds. Proceeding to deal with the subject-matter of the patents, counsel said that the first patent consisted of a dynamo swung under the carriage in such a manner that the driving-belt which connected it to the carriage axle-pulley slipped the moment the speed of the train passed a predetermined point, thus allowing the dynamo speed to remain constant. In fact, said counsel, it becomes a question of a fight between torque and weight. There was one difficulty, however, about this system, and that was that it caused a jumping in the lights when the train stopped, owing to certain resistances being cut out. Plaintiff then improved upon this by inventing a system whereby the armature of the dynamo revolved idly until a certain speed was reached, and then by a clutch system an electrical connection was made, and the dynamo connected up with the battery which fed the lights. This system had an advantage inasmuch as it did not matter which way the train went. By the ingenious arrangement of the poles, whether the train was running backwards or forwards, the current from the dynamo still continued to flow into the battery and to charge the battery when the train ran backwards. This system was worked with the single storage battery, and it had several disadvantages. At last, however, plaintiff perfected his device and patented a system which enabled Messrs. Stone to obtain world-wide recognition for their train-lighting installations, and secured their reputation in this work. In the new patent plaintiff introduced the use of two accumulator batteries, one being charged by the dynamo, whilst the other was available for giving out the current to the lights. This system obviated the pumping up and down of the lights, which had hitherto been a disagreeable feature of train lighting. In respect of these patents, disputes now arose as to the amount of royalty to be paid to Mr. Gill.

Mr. Gill, in the witness box, said he became acquainted with the defendant firm in 1893, and prior to that date he had been experimenting with devices for lighting trains by electricity. He then described the history of his connection with Messrs. Stone, as stated by counsel, and said that under the agreements he was precluded from interfering with the financial side of defendants' business; he used to receive his royalty accounts quarterly, but had no means of checking them. He thought he was receiving 10 per cent. on all fittings and apparatus supplied by Messrs. Stone for lighting railway carriages and also on all spare parts. His double-battery system got over the difficulty of "blinking" lights. It also gave a much larger scope to the lighting. For instance, in the sleeping or dining cars where there was a varying number of lights, it obviated a disadvantage which obtained under the single-battery system. When some of the lights were turned out, the remaining lights would get too much current and burn much brighter or perhaps burst. The two-battery system stopped that inasmuch as one battery acted as a regulator whilst the other was being charged. If the lamps were only taking 20 amperes, and the dynamo was making 30 amperes, what would happen would be that the output of the dynamo would be carried to a point behind a resistance; then only 20 amperes would feed into the lamps, and the remaining 10 amperes would go into the battery which was being charged. By such a system it would be seen that it did not matter what was taking place with the dynamo—the lamps would not be affected. Referring to a link suspension device in connection with a system of train lighting patented by him in 1896, plaintiff said that the old arrangement of adjusting the dynamo to give the desired output was by means of an arm screwed on to the back of the dynamo with a balance weight, so that the weight could be regulated on the pulley. It was, however, very unsatisfactory, because the vibration of the train caused the apparatus to break away. It was to remedy this that he invented the link suspension, which introduced a screw whereby the tension on the dynamo belt could be regulated. This alteration, said plaintiff, was absolutely necessary to the success of the system, and was now used on every electrically-lighted railway carriage.

Mr. Colefax: And what are the defendants suggesting now on the assumption that Clause 8 applies?—I understand they are suggesting that they should pay me a royalty at the rate of 10 per cent. on the link and the adjusting screw only, and now defendants do not generally supply this particular link, but allow the railway companies to fit that to the lighting apparatus themselves.

The double-battery system, said Plaintiff, possessed advantages over anything which he had patented before, and except for the introduction of a resistance, was substantially the same system that was still used by Messrs. Stone & Co.

Mr. Colefax: But defendants are proposing to pay you nothing in respect of the batteries by way of royalty?—That is so.

Another claim, said Plaintiff, was on a patent of his taken out in 1899 in respect of a magnetic switch. A difficulty arose in connection with long-distance trains, such as a train, say, from London to Dover. It was necessary to have one lamp on in each compartment throughout the journey for the tunnels, as there was no means of switching on the lights for each carriage when a tunnel was reached. There was a switch attached, of course, to the outside of each carriage, but it was impossible for the guard to reach them when the train was travelling. Plaintiff's 1899 patent, however, was a magnetic switch connected from the guard's van to the ordinary hand switch of each carriage, and with this the guard could control the lights throughout the train. When he turned on the switch, it sent a current of electricity along the carriages which, actuating the electro-magnets on the carriage switches, turned the lights on.

Counsel: Is that combination now used by Messrs. Stone & Co.?—They use a later pattern of the same thing and propose to pay me on the old form of switch which they do not now supply.

Questioned as to the resistance plaintiff had spoken about when describing the two-battery system, he said that that was a modification of the two-battery system and the subject of a later patent, but its inclusion was a matter of considerable importance in obtaining a really successful system. Before its introduction, when the train stopped, the short-circuiting lever cut out the whole of the resistance, and the battery which had been charging while the train was in motion was immediately connected direct upon the lights, causing a rush of current to the lights. The introduction of the resistance obviated this. The combination of the double battery, resistance and short-circuiting switch gave perfect control over the lights. In respect of this combination, however, defendants did not propose to pay plaintiff anything upon the batteries, only upon the automatic switchboard and the hand switch for putting the batteries in parallel.

Plaintiff was next examined in respect of a claim for royalty on a cable of particular construction which he invented, its chief feature being a helical wrapping of non-inflammable tape, which rendered it safe from the accident of fire. Plaintiff explained that they found it of the utmost importance to have non-inflammable cables for wiring up the lighting installations on trains, because they had cases where railway carriages had been burnt down entirely through sparks from the engine alighting on the electric cables and consuming them. In this way there had been some bad accidents, and so plaintiff designed the cable in question. Messrs. Stone still used it, but for some reason or other they now refused to pay him a royalty upon the sales.

Mr. Colefax reverted to the dynamo portion of the installation, and in answer to questions upon this subject, plaintiff said that this method of supporting a double-arm rocking lever attached to the dynamo had been used by Messrs. Stone & Co. on every installation they manufactured. The dynamos used in the system were sold by defendants at the following prices:—£48 10s. for type A.R.; £60 10s. for type C.R.; and £80 for type D. The C.R. type minus the rocking arm, &c., fitted to it could be procured on the market for £17, manufacturers' selling price. In respect to the A.R. and C.R. types, defendants had picked out the friction gear, value £1 10s.; the rocking arm, £1 5s., and the front bearing bush, 18s. 9d.; and on those parts only they proposed to allow plaintiff 10 per cent.

Plaintiff, further examined by Mr. Colefax, said that his system was used by nearly every railway company in this country, and in India the Railway Board had given an order that in future Stone's system should be used on first and second-class coaches on the railways of that Empire.

Do you know whether Messrs. Stone & Co. sell the installation in parts or as a whole?—As a whole.

Plaintiff said that a case had come under his notice of a dynamo which was supplied to the Canadian Pacific Railway as a renewal, and the price charged by defendants, he believed, was £60 10s. That machine had the rocking lever attached.

Counsel: In respect of the dynamo, including the automatic switchboard, I understand that defendants propose to pay you 10 per cent. on a sum of £6 4s. 9d.?—That is so; it works out at about 12s. 6d.

Have you estimated what they propose to pay you on the whole installation?

Witness could not say off-hand, but it was a very small amount. Under the licence granted by Messrs. Stone & Co. they reserved for themselves a royalty of about 10 per cent. He remembered a licence which was granted to one Koch, of Vienna. He did not, however, hear about it until after he left the firm, and then he wrote objecting to the licence having been granted without his sanction.

Cross-examined by Mr. Bousfield, K.C., on the question of his resignation as manager, Plaintiff said he objected to interference with him in his capacity as manager of the technical department. The commercial gentlemen of the firm were trying to answer very technical electrical questions instead of leaving such matters to him, and as a consequence a fearful amount of the time of the firm and its customers was wasted.

Cross-examined as to the prices charged for dynamos, Plaintiff admitted that the prices asked for a machine depended largely on whether there was competition or not in the particular machine. It was also true that a bigger price could be obtained for a machine before the patent lapsed.

Mr. Bousfield: You will remember that your patent of 1896 for the dynamos lapsed in March of this year?—Yes.

And in April of this year defendants reduced the price of A.R., C.R. and D types to £39 4s., £45 10s. and £64 15s.!—I did not think the prices were reduced so far back as April; I only heard of the reduction about two months ago.

Have you, during the last few months, been giving your mind to this system with the object of improving it and keeping it up to date?—It is up to date; it is the best system in the market, and there is nothing to touch it.

Have you been doing, and are you going to do, your best to keep the system up to date?—I cannot improve it; it is as perfect as any system can be for railway carriage lighting. It has been adopted as a standard, and other makers are not cutting into Messrs. Stone's business at all.

And therefore you have no intention to give your mind to improve Messrs. Stone's business?—I do not say that; I have had no opportunity of doing so since I left.

Plaintiff remembered that in 1904 and 1906 Messrs. Stone could not get out a sufficient number of dynamos to supply the demand, and so they bought dynamos from their licensees already made up ready for use. They were nearly all of the C.R. type.

Mr. Bousfield: Do you remember that Messrs. Stone had to pay their licensees £30 per dynamo?—I know we had to pay a high price, and there was a great fuss about it; but they asked a high price because they had not the experience in making these dynamos. Messrs. Stone only gave them orders for 100 dynamos in one case and 50 in another, and when compared with Messrs. Stone's output of something like 30,000 machines, one could not expect their people to make the dynamos at the same price at which defendants could make them.

You say that at the present time your system is at the top of the tree. Do you know that at the present time there are a number of competitors who have succeeded in introducing their systems side by side with yours?—That is so.

Take Messrs. Vickers, Sons & Maxim. They have got a system of their own which has been put in side by side with yours on several railways?—It has been put in on a few.

Well, there is the London and South-Western Railway; the Caledonian Railway; the Midland and the Great Central Railway?—Yes, but where Messrs. Vickers, Sons & Maxim have two or three dynamos in use, we have 500 or 600.

But Messrs. Vickers, Sons and Maxim's is a perfectly live system?—It works, but it is not a success.

I put it to you that to-day this system is running on the railways side by side with yours?—If Vickers's system were as good as Messrs. Stone's, Messrs. Stone would not get a look in.

Why?—The railway companies would prefer Messrs. Vickers, for reasons I do not wish to go into, but I will if you prefer it.

The Lancashire and Yorkshire Railway is running three systems side by side, is it not; yours, Messrs. Vickers, Sons & Maxim's, and Messrs. Mather & Platt's?—They are only being tried.

Has the South-Western got your system?—Yes, it is fitted to the royal carriage.

But in the bulk of carriages is not Leitner's system fitted?—It is fitted in a few cases, but if you want to know why these other systems are fitted I will tell you, but it will make it very awkward for Messrs. Stone. Therefore I should advise you to avoid these questions. Our system is the simplest and most flexible that can be got.

But it has to be kept up to date?—It is kept up to date. The reason why Stone & Co. reduced their prices was nothing to do with competition.

Pressed by Mr. Bousfield, Plaintiff said that in his opinion defendants thought it best to reduce their prices in view of the present proceedings.

Further cross-examined, Plaintiff denied that the idea of individual carriage lighting was an old one. He understood he was the first person who fitted up the individual carriage lighting system. The old way of lighting used to be by a dynamo in the coach van, and there was only one battery used, on the block system.

Your system is a dynamo worked from the axle of the railway carriage wheels charging two batteries alternately, and which are used alternately for lighting. Before 1896 you were charging one battery only?—That is so.

Your improvements had chiefly to do not with the character of the batteries, but the way in which they were connected up to the rest of the apparatus?—Yes; we had no patent taken out on the actual battery plates, although they were my own design. We registered the designs, that was all.

In devising the dynamo to charge the battery from the railway axle you had to provide for the variation in the speed of the train?—Yes.

And you did so by a pair of governors which, when a certain speed was reached, put in contacts connecting up the accumulators?—Quite so.

Also sometimes the train would run one way and sometimes another, and so you had to provide that the direction of the connection with the accumulators should be different according to the direction the train was running, and you did that by means of the rocking lever?—That is so.

You also provided against the dynamo being run at too high a speed by a slipping belt device?—Yes.

Those are the essential features of your system?—Plaintiff admitted they were.

And they were contained in your first patent?—Plaintiff admitted that they were. He denied that there was nothing new about the resistance he had introduced into the system. Hitherto people had tried to work out everything electrically, but he was the first to conceive the idea of using simply mechanica means in connection with his system. Others had tried to use mercury cut-outs, for instance, on railway lighting systems.

Mr. Bousfield: That is a long way off, is it not?—Plaintiff: Oh no, the mercury cut-out is in use now.

On what system?—Well, Leitner's used the mercury cup on their system until a short time ago, and on the Brighton Railway, where there were block trains, they always used mercury cups.

Did you know when you took out your two-battery patent that some one else had suggested a two-battery system shortly before?—No, I did not know that. I had been trying for some time to divide the old single battery, but the difficulty was the question of expense. The railway companies would not pay more, and what I was endeavouring to do was to divide the battery into two without increasing the cost.

Further cross-examined, Plaintiff said it was true that in certain cases the railway companies now found their own batteries, but Messrs. Stone had fought to the last gasp to prevent it, and get the railway companies to accept their patent battery system with the installation. In some cases they were successful, but in the other cases they were not strong enough and had to give way and allow the railway companies to supply their own batteries.

Examined as to the magnetic switch which formed part of plaintiff's claim, Mr. Gill said it was true magnetic control was a well-known thing, but it had not been applied to this particular form of switch before, and therein lay his claim. A certain necessity arose, and he invented something to meet that necessity.

Models of the apparatus were erected in Court, and Plaintiff was cross-examined by Mr. Bousfield at considerable length upon them. With regard to the rocking arm, frictional gear, &c., upon which defendants proposed to pay plaintiff a royalty, Mr. Gill said that he claimed a royalty upon the whole dynamo, because, without the parts in question, the machine would be useless.

Questioned as to the cable, Plaintiff said that the reason why he put a wrapping of non-inflammable material next to the wire was in case the wire should get heated and fuse the adjacent rubber wrapping.

A non-inflammable cable was an ordinary thing on the market?—Not with rubber in it. We could not obtain it at the time, anyway. It is true there were cables with non-inflammable tape coverings, but they were no good for insulation. It was certainly no good for railway carriage lighting. The damp used to get in between the wrapping, and setting up a chemical action destroyed the conductivity of the cable. His cable, besides being non-inflammable, was not open to this objection.

Further cross-examined: Plaintiff said that defendants granted licences to foreign firms without asking his permission. He had never seen them, and did not know what was in them.

Do you object to the terms of these licences?—No, I never have done so, all I say is I ought to be consulted on the terms of them.

(*To be continued.*)

Babcock & Wilcox, Ltd., *v.* Edwin Danks & Co. (Oldbury), Ltd.

This case was in the list for hearing in the Court of Appeal, before the Master of the Rolls and Lords Justices Moulton and Farwell, upon the plaintiffs' appeal from a judgment of Mr. Justice Warrington.

The action was brought to restrain the defendants from infringing Letters Patent No. 20,779 of 1898, granted to plaintiffs and Mr. J. H. Harrison for improvements in gas combustion chambers for steam boilers and other furnaces. Mr. Justice Warrington held that the plaintiffs had failed to establish infringement and dismissed the action with costs. He also dismissed the defendants' counterclaim, which attacked the validity of the patent.

Before the appeal was called on, Mr. Colefax, for the appellants, said that the case had been settled, and he wanted to take a consent order, but his learned friend on the other side was not present.

Lord Justice Moulton said the learned counsel had better mention the matter then and take the order subject to the other side objecting afterwards.

Mr. Colefax said he understood that the defendants were willing to consent to judgment being entered for the plaintiffs for the relief asked for in the statement of claim.

The Master of the Rolls: What about costs?

Mr. Colefax: We are to have costs.

The Master of the Rolls: You had better take the order as a consent order.

Mr. Colefax: I will indorse my brief "by consent," and if my friend consents there will be no need to mention it again.

The Master of the Rolls: No.

E.M.F., Ltd., *v.* W. Barnes & Co.

In the Lord Mayor's Court on Friday, before the Recorder and a jury, plaintiffs sued defendants, electrical engineers and contractors, to recover £31 8s. 9d. for goods supplied. Mr. Frank Dodd appeared for the plaintiffs, while the defendants were not represented by counsel. Counsel for the plaintiffs stated that the defendants had pleaded in such a manner that the company were obliged to prove their claim. The only matter which was in doubt, however, was a counterclaim which had been raised by the defendants. In this counterclaim the defendants asked for damages for loss of customers which they had sustained by reason of the electrical goods which the plaintiffs had supplied being defective. The counterclaim came to a little more than the amount the company were suing for.

The defendants did not counterclaim for the value of the fittings supplied, but stated that, owing to the goods being defective, they lost certain customers which they would otherwise have had. Counsel said he did not think that the counterclaim could be maintained, as he thought it was too remote. The Recorder (interrupting) said that he was inclined to think that the damages on the counterclaim were entirely too remote to be substantiated. After hearing the evidence of the defendants, the jury found a verdict for the plaintiffs on the claim and counterclaim, and judgment was entered accordingly, with costs.

Claim Against Tramway Company.

In September, 1909, Miss Margaret Booth Day, of Belsize Road, Hampstead, cycled across the London United Tramway Co.'s rails at Chiswick, with the result that her machine slipped, and in falling she sustained injuries from a passing car.

Before Mr. Justice Phillimore and a common jury, on Monday and Tuesday last, she said that the tram company's rails were in a bad state of repair, and this fact caused the accident. She claimed £500 damages. The jury awarded her £77.

Gould *v.* Lehwess.

The rehearing of this action was begun in the King's Bench Division on Monday, November 7th, before Mr. Justice Ridley and a special jury.

Mr. Atkin, K.C., and Mr. Douglas Bartley were for the plaintiff, and Mr. F. Gore-Browne, K.C., and Mr. H. A. McCardie for defendant.

Mr. Atkin said the defendant was Dr. Edward Ernst Lehwess, a gentleman who held a scientist's degree in a foreign university, and who knew a good deal about electricity. He also knew a good deal about the promotion of companies, and especially motor and omnibus companies. The plaintiff was Mr. Chas. A. Gould, a gentleman of considerable financial position in America, and president of the Gould Electric Storage Co., which had a capital of five million dollars, and which was engaged in providing electric motors. The plaintiff had also the advantage of being Commodore of the New York Yacht Club, and was known as Commodore Gould. Dr. Lehwess went to America and met Commodore Gould, and by an agreement made on November 1st, 1906, between the plaintiff and defendant, it was agreed that the defendant should form a company, to be called the Gould Storage Battery Co., to introduce into England the Gould Storage Battery, of which the plaintiff was the inventor and manufacturer in America. It was agreed that the company should have a cash capital of £25,000, and that the company should start operations by letting out and maintaining batteries in five omnibuses of the London Electrobus Co. under a contract. On November 20th the defendant registered a company called the Gould Storage Battery Co., with a nominal capital of £25,000, and cables followed which led the plaintiff to believe that the company had been floated, and that there was a cash capital of £21,000. The plaintiff relied upon this contract, and delivered to the company 15 sets of batteries of 42 cells, each to be paid for by the company at the price of $800 per set at the end of six months. It was arranged that Mr. Vaughan should test the batteries, and the engineer passed them as satisfactory. In 1906 the defendant had taken a great deal of interest in the London Electrobus Co., and although not a director he was in a position to control the company, which had a garage at Westminster and offices in Whitehall. The defendant was also largely interested in the London Electric Vehicles Co. After his visit to Mr. Gould in New York, Dr. Lehwess came to England with the object of supplying motors for the Electrobus Co., Mr. Gould stipulating that the company should be a substantial one. The defendant agreed to this, and, in fact, deposited $10,000. He was to have a controlling interest—55 per cent. of the share capital of the company. On November 2nd the defendant did register the company, with the nominal capital of £25,000, but, said counsel, on the same day he caused it to be incorporated with the Asiatic Banking and Trading Corporation, Ltd., a company registered in Guernsey, with a paid-up capital of seven shares, a company which had never done any business, had no property, and no directors. The plaintiff contended that the defendant did not register the company with a cash capital of £25,000, or, in fact, with any cash capital, and the company had never paid for these batteries, and was not in a position to do so. The claim now was in respect of the goods supplied, $15,626 = £3,208 15s.; and $13,776 = £2,828 15s., or otherwise for damages for these amounts.

On Tuesday, Mr. Atkin read lengthy correspondence with reference to the testing of the batteries that had been sent over from New York to the London Electrobus Co.

(To be continued.)

Marconi and Others *v.* The British Radio-Telegraph and Telephone Co., Ltd.

With the consent of all parties, Mr. Justice Parker, sitting in the Chancery Division, has decided that the hearing of this action shall not take place before November 28th.

PROCEEDINGS OF INSTITUTIONS.

Water-Tube Boilers.

In a paper read before the Manchester Association of Engineers on October 22nd, Mr. D. Wilson discussed the advantages of water-tube boilers as compared with other types. He pointed out that 60 per cent. of the boilers used in electric power stations were of the water-tube type, and stated that in the course of many tests he had often obtained efficiencies as high as 78 per cent. and over, where the boilers were fitted with mechanical stokers and superheaters. Careful tests at the L.C.C. tramways power station, Greenwich, in March, 1909, on a boiler having 4,780 sq. ft. of heating surface, and a grate area of 88 sq. ft., evaporating 19,391 lb. of water per hour, with a superheat of 107° at 200 lb. pressure, showed an efficiency for the boiler alone of 78·13 per cent., and a combined efficiency of boiler, superheater and economiser of 84·97 per cent. In London, where coal was expensive, the lowest fuel costs were obtained at stations using water-tube boilers:—

Average Cost per Unit Sold.

	Coal.	Repairs and maintenance.	Total works cost.
	d.	d.	d.
West Ham Corporation Elec. Works	·25	·11	·43
Central Electric Supply Co. ...	·27	·08	·45
Metro. Borough of Hackney ...	·27	·12	·50
" " Poplar ...	·29	·09	·46
" " St. Marylebone	·29	·21	·64
County of London Elec. Supply Co.	·33	·25	·72

And in the provinces, where coal was cheap:—

Glasgow Corporation Electric Works (Tramway station)	·12	·08	·32
Leeds Corporation Elec. Works ...	·17	·12	·37
Coventry " " ...	·18	·08	·35
Motherwell " " ...	·18	·07	·38
Bradford " " ...	·18	·14	·42
Sunderland " " ...	·19	·13	·42

Having had under his charge an installation of 46 water-tube and 16 cylindrical boilers, he did not find that the former cost more for repairs and maintenance than the latter. At West Ham the repairs and maintenance costs per annum averaged £7 per boiler of 4,900 sq. ft. heating surface; at Hackney, £7 10s. per boiler of 3,000 sq. ft.; and at Lots Road, £10 per boiler of 5,212 sq. ft. At Lots Road only 65 tubes had been replaced out of 15,360 in seven years; and at Marylebone only six out of 5,750 in five years; while at Wood Lane, where the boilers were habitually run at heavy overloads, no tubes had been replaced in 10 years.

The saving in space of the water-tube boiler, allowing for its overload capacity, was very great; with cylindrical boilers the evaporation per hour per square foot of floor space was about 21 lb. with Lancashire boilers, and 53 lb. at least with the water-tube type. This was a very important matter where steam turbines were used.

The margin for improvement in efficiency was very small; the total loss in the L.C.C. test was 22 per cent., and owing to the impossibility of reducing the temperature of the gases to that of the water in the boiler, only a trifling saving was practically possible in the boiler—about 1 per cent. The temperature of the gases leaving the economiser could only be reduced by adopting artificial draught, which introduced other costs, and as the loss by radiation was about 5 per cent., the possible improvement was only about 2½ per cent.

The cost of cleaning water-tube boilers at Lots Road was £7 each per annum, and at Marylebone £6 per annum.

Repairs and maintenance of brickwork at Marylebone and West Ham cost £4 14s. and £5 respectively.

By using the marine type of water-tube boiler, the whole space covered by the boiler could be utilised as grate area, and this had been done at the Carville and Dunston stations, at St Denis (Paris), and at the works of the Victoria Falls Co. in South Africa.

Where large quantities of steam were required for heating purposes as well as for power, a great economy could be effected by using high-pressure engines, which received steam at 200 to 250 lb. pressure, and exhausted it at 40 to 60 lb. above atmospheric pressure. At a chemical works in Birmingham a recent test showed that in this way electric power could be generated at a cost of about 60 H.P.-hours for 1d.

Care must be taken to prevent oil passing into the exhaust steam, if the latter was to be used for direct heating by contact with the liquid to be heated. This system had been adopted in several instances, and there must be many installations in the neighbourhood of Manchester, where the cost of new plant would speedily be recouped by the large saving that could be secured.

A large firm of ironfounders in the Middlesbrough district were installing exhaust-steam turbines and high-pressure water-tube boilers with superheaters, the boilers being fired with blast-furnace gases; by this means the whole of the power used in the iron and steel works would be obtained from the waste gases. Over 100 Lancashire boilers, which had been fired with blast-furnace gas, were to be removed and replaced by water-tube boilers, which had been found more efficient than the former when fired with gas.

Great economies could be effected by careful attention to the working of the boilers, by using purified feed water, keeping the

surfaces of the tubes and flues clean, and controlling the combustion; this was proved by the enormous reductions effected in fuel costs at various large electric power stations during the past five years.

Institution of Electrical Engineers (Newcastle Local Section).

On October 31st the chairman, Mr. C. Faraday Proctor, delivered his inaugural address, the subject being "Practical Education." Referring to his experience on the Continent in 1881, he compared the foreign with the English factory hand, to the disadvantage of the latter as regards personal neatness, orderliness and elementary education, though the latter possessed greater initiative. He supported his criticism of present-day methods of education by quotations from the papers read at the British Association, urging that insufficient attention was given to the use that the student was making or was intended to make of his education. Sir John Gorst had said that more technical and practical instruction should be given to the children in the elementary schools. In the case of candidates applying for posts, a long list of examinations passed tended to depreciate the chance of success of the candidate, since it indicated a want of practical experience and implied lack of observation. Such a man must have gained his knowledge from books, whereas the processes in use in factories were far in advance of the text-books. The want of appreciation shown by the theoretical student for his practical associates in college or works often led to a breach between the theoretical and practical sections of a works, and to a want of efficiency, especially in the theoretical departments.

Mr. Proctor gave examples from his own experience to show the importance of attention to detail in practical work and of close co-operation between the practical and theoretical departments as well as the commercial department. He went on to point out the successful achievements of Germany and America, as compared with this country, which he ascribed to a good combination of capital and labour, theory and practice, backed by good commercial ability. He believed in the innate abilities of the British, but considered that they were handicapped by the lack of practical education.

Mr. Proctor concluded by advocating the adoption of the metric system and decimal coinage, declaring that the problem was how to obtain a majority in favour of greater efficiency in life and learning.

Private Plant for Factories.

In a paper read before the Birmingham and District Electric Club, Mr. Vernon C. Brook said that there were many instances in which it would pay to put down a plant rather than take a supply from the supply authorities, apart from those cases in which a public supply was not available. The most important factor to consider in most cases before putting down a private plant was that of capital outlay. Providing the necessary capital was available, the question to be considered was whether the money involved could be more advantageously spent in additional productive machinery or on alterations, with a view to improving the efficiency of existing plant. The question could only be dealt with on its own individual merits, but he pointed out that it was not only a question whether the space occupied by the generating plant could be better used if covered by productive machinery, because the space required by generating plant was but a very small proportion of the total area of any works. As an example, he would take the case of a works requiring 1,000 H.P. to drive it, and assume it to be electrically driven from a private generating plant, the total cost of which, including buildings and chimney, would be roughly £10,000. If then this £10,000 were to be spent on additional productive machinery, £8,000 was available for machinery, the remaining £2,000 being required for the buildings, land, &c., in either case. But the building would not be nearly large enough to accommodate £8,000 worth of machinery occupying some 3,500 sq. ft., as the 1,000-H.P. plant would only occupy about 500 sq. ft., or one-seventh. The money required to build the necessary 3,500 sq. ft. would not be seven times £2,000, but four times, leaving only £2,000 for machinery, which sum would not be enough to buy machinery to fill the space. Both figures would have to be adjusted until the proper balance was obtained, say, two-thirds of the original for buildings, and the remaining third for machinery, giving £3,333. It was very questionable whether the sum would bring in as good a return as would have been the case had it been spent on generating plant producing energy at one-third of a penny per unit.

It was seldom that a private generating system had to spend so much money as a public supply company on its transmission apparatus. This fact tended to keep down the cost of energy in the case of the private plant In the mills of Messrs. Ashworth, Hadwin & Co., Ltd., of Fairfield, who had recently put down their own generating plant and electric driving, one generating unit was an 800-KW. turbine set. The running cost of this was:—Coal, oil, waste, and stores, ·132d. per unit; interest and depreciation, repairs and maintenance, ·131d. per unit; total, ·363d. Messrs. Watson Bros., Linwood, had a 500-KW. plant in two units of 250 KW. The average cost of a month's run was ·387d. per unit, the number of units generated averaging about 55,000. Another factory had a generating plant consisting of two 500-KW. turbo-generators, the average load on which was 880 KW. The total cost per unit generated came out at ·32d.; and the success of a private plant from the financial standpoint lay in the two items—load factor and efficiency.

The turbine was fast coming into popular favour for private generating plants. Less floor space was required for a given size of engine, the foundations need not be so heavy or expensive, and the reduced steam consumption of the heavier sets was considerably in their favour. Large gas or oil engine units were rapidly coming to the fore. A large gas-engine installation complete, with producer and all auxiliaries, was more costly than a steam installation, complete with boilers, &c., but against this was the fact that the gas engine was more economical as regarded fuel consumption than any known external combustion engine. The cost of upkeep was practically the same in each case. With respect to smaller sizes of gas engines for small generating plants, it was very difficult to beat the suction-gas system as regarded economy and prime cost, though the upkeep of such plants was rather high. A 50-KW. set, running on town gas at 2s. per 1,000 cb. ft., working 53 hours per week and generating 106,000 units per annum with a 35 per cent. load factor, cost per unit 1·23d. The same plant, working on suction gas cost ·985d. The figures for a 200-KW. gas-driven set having a 25 per cent. load factor and producing 438,000 units per annum, working on producer gas, came out at 0·735d. per unit. The figures would not hold good for a lighting plant only, as the load factor would be very much lower, and the cost per unit would rise considerably. Where a public supply was not available, the author would recommend gas engines and producer plants for installations from 10 to 50 H.P., high speed reciprocating steam engines or oil engines, such as the Diesel and vertical or horizontal gas engines, for powers from 50 to 500. From 500 H.P. the oil engine dropped out and the steam turbine came in. For the small powers below 10 H.P., petrol and paraffin sets were particularly suitable, being both simple and efficient. The cost of running the Diesel oil engine, from figures obtained by the Daimler Motor Co., came out at a little over ·3d. per unit. It must be understood, however, that they have a particularly high-load factor. Gas and oil engines cost from about £25 per KW. complete with plants of about 50 to 80 H.P., down to £15 complete in plants of 500 H.P., there being little difference in the cost of oil engines compared with gas engines.

As to whether alternating or direct-current plants should be installed, there had been a great diversity of opinion, but latterly it had been in the direction of alternating current.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Eclipse Heaters.

With the publication of its new Electric Heating Catalogue, the Electric and Ordnance Accessories Co., Ltd., of Cheston Road, Aston, announces the introduction of three new patterns of

Fig. 1.—Ornamental Eclipse Heater.

heaters, in cast-iron, and of ornamental appearance. We illustrate two of these heaters, the larger one, standing 23¾ in. high, having art glass panels at the front and sides, and consuming 1½ units per

hour at full heat, while the smaller size, 14 in. high, is provided with a copper reflector, and consumes ¾ unit per hour.

Fig. 2.—Eclipse Heater with Copper Reflector.

The catalogue illustrates numerous artistically designed heaters in copper, brass, iron, &c., also lamp radiators, railway and ships' heaters. Complete data are included in each case.

Secret Conversation Intercommunication Telephone.

A system of intercommunication telephones has just been introduced by the Sterling Telephone and Electric Co., Ltd., of 200, Upper Thames Street, E.C., which combines with absolute secrecy a number of ingenious and valuable improvements. It is a

Fig. 3.—Sterling Secret Telephone: Table Pattern.

double-line system throughout, a cable containing as many pairs of conductors as there are instruments being led from each station to a central distributing board, where the whole of the connections are concentrated, the method of connection employed being extremely simple. The unique feature of the instruments is the provision of a distinct visible calling signal, in addition to the usual audible signal; the former takes the form of a small incandescent lamp over each lever, which remains alight until the call is answered, thus indicating the line on which the call is received. On pressing the lever beneath it the lamp goes out, the two stations being then connected on a double line, and totally isolated from all other circuits, so that the conversation can neither be interrupted nor overheard. If the person called is not present, so that no answer is received, the signal lamp goes out when the caller hangs up his telephone. There is always one lever in the down position, and it may happen that a call is received upon that particular line, the signal lamp of which is out of circuit; in that event an auxiliary green lamp lights up, and indicates that the call has come on the line in question. Depressing one lever, of course, restores any other that may be in the depressed position.

A person whose instrument is in use cannot be called until he has finished his conversation. Should anyone attempt to call a post that is engaged, the fact is automatically revealed to him in

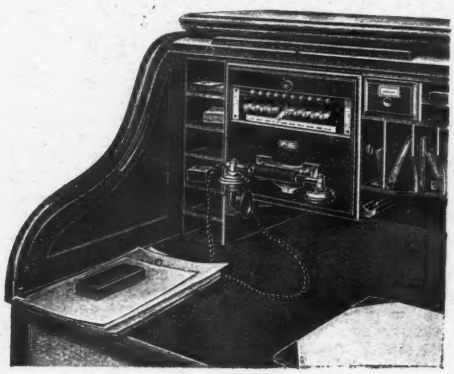


Fig. 4.—Telephone Fitted inside Desk.

this way: whenever an effective call is made, a buzzer sounds in the caller's instrument as well as at the remote station; if the caller's buzzer does not sound, he knows with absolute certainty that the person he wants has not been called.

A common battery is used for calling, and local batteries for the microphones. The appearance of the instrument is shown in fig. 3, which is the table pattern. A wall pattern is also made, and fig. 4 shows how conveniently it can be adapted to the interior of a roll-top desk. The table instrument can also be mounted on a handsome pedestal, and an installation comprising a large number of these has recently been carried out by the Sterling Co.

Fig. 5 shows the appearance of the connection board, inside and outside.

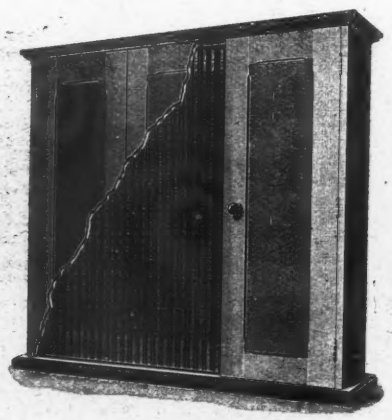
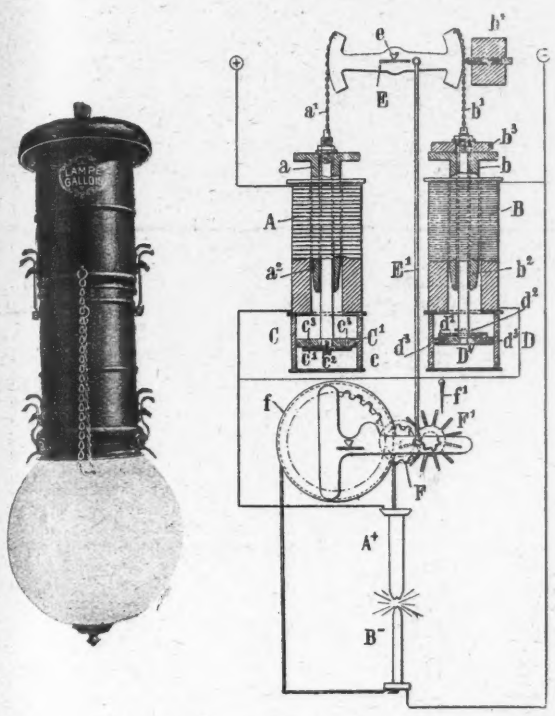


Fig. 5.—Connection Board.

Gallois Flame Arc Lamp.

This lamp is being placed on the market by the Wells Electrical Co., of 73, Cheapside, E.C., who are the sole agents for Great Britain. It is of the vertical carbon type, as shown in the accompanying illustration of the interior, with regulating mechanism of the differential type. The shunt and series solenoids A and B (fig. 7) are separate, and are provided with cores, *a b*, suspended from a beam E by chains, a^1, b^1, the beam being carried on knife-edges *e*. The ends of the cores are coned to give uniform pull, and the shunt core is ballasted with a weight in conjunction with the counter-weight b^4. The carbon-holders are carried by a flexible cord or chain passing over the pulley *f*, and the upper holder is heavier than the lower, so that their tendency is to run together. A train of gearing ending in a star-wheel F^1 controls the pulley, being coupled to the rocking beam by a link E^1; the frame carrying the

train is mounted upon knife-edges eccentric to the axis of the pulley f, so that when the frame is tilted, the star-wheel being held from turning by the stop f^1, the pulley is rotated slightly, and the arc lengthened or shortened. The series core is provided with an air dash-pot C of special construction, the piston having holes c^3, and a light aluminium disk c^1 beneath it, supported by the screw c^2. On closing the circuit the series solenoid is strongly energised, and tends to cause an abrupt downward motion of the core, but the aluminium disk, acting as a valve, closes the holes in the piston and brings the dash-pot into play. The shunt dash-pot is similar, but inverted. On the cessation of the current, on the other hand, the carbons are liberated by the free fall of the



Figs. 6 and 7.—Gallois Flame Arc Lamp and Mechanism.

shunt core, and come together quickly. In normal working the dash-pots exert only a weak control, allowing the beam to respond to the least differences of pull of the two solenoids, and to keep the arc steady; and when the arc burns to too great a length, the shunt core descends sufficiently to allow the star-wheel to rotate slightly, feeding the carbons, after which the shunt core rises and the star-wheel is again stopped.

For continuous current, the upper (positive) carbon is cored and the smaller negative is solid. The lamps can work three in series on 110 volts, or five on 200 volts. They are also made for alternating current, and work with either ordinary or flame carbons. A variety of patterns is made.

BUSINESS NOTES.

Eiffel Tower Pumps.—The Worthington Pump Co., Ltd., have secured the contract for installing in the Eiffel Tower, Paris, a complete new installation of electrically-driven pumps. The existing steam installation, which was put into position some years ago, was manufactured by the same firm; it is, we are informed, at the present time in first-class condition, and is offered for sale by the company. We understand that it is owing to the very satisfactory working of the steam set that the order for the electrical plant was placed with the Worthington Co. when the electrification was decided upon.

Book Notices.—*Log Book of Electric Light Installation.* Issued by Hubert Russell, 40, Sackville Street, London, W. Price 30s. net.—This log book is a remarkable production; a log book *de luxe*. It is handsomely bound in leather, and is foolscap size, the paper being of excellent quality. Its purpose is to provide for a complete detailed record of the working of a private electric light installation, over a period of five years, superseding loose sheets of paper and other ephemeral registers, and doubtless the handsome get-up of the book is meant to impress the attendant with the importance of keeping it up-to-date and in good order. The printed matter comprises a glossary of electrical terms, outline particulars of the installation with blanks for data, price lists of lamps, stores, &c., instructions for working the dynamo, forms for a daily, weekly and quarterly record of the hours of running of the engine, and for meter readings, instructions for working accumulators, forms for a monthly record of the E.M.F. and specific gravity of 111 individual cells, forms for recording the daily running of an electric motor, and forms for extracts from inspectors' reports, and for a monthly statement of the detailed working costs of the installation. It will be seen that the log book is very comprehensive, and that if such a log were conscientiously and fully posted it would constitute a record of great interest and value to the owner. The different sections are made readily accessible by substantial index slips, and the volume is evidently designed to endure five years' hard wear without material depreciation.

"The I.C.S. Student," the journal of the International Correspondence Schools, Limited, Kingsway, is now provided with a weekly edition or supplement compiled by the Students' Aid Department, and containing a register of vacancies for technically trained employés.

The Physical Review. Vol. XXXI, No. 4, October, 1910. Lancaster, Pa.: The Physical Society.

The College Quarterly. No. 4, August, 1910. Melbourne: The Working Men's College. Price 6d.

"Technical Dictionary in Six Languages." By Alfred Schlomann. Vol. X., Motor Vehicles. London: Constable & Co. Price 12s. net.

"*Transactions* of the Illuminating Engineering Society," Vol. V., No. 6, June, 1910. Easton Pa: The Society, Price 75c.

"*Proceedings* of the Engineers' Club." Vol. XXVII, No. 4, October, 1910. Philadelphia: The Club.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 8, October, 1910. New York: The House of the Society.

The Turin Exhibition.—In view of the great amount of public interest which has been aroused by the work of the Exhibitions Branch of the Board of Trade with regard to Brussels, Vienna and Buenos Ayres, it may be interesting to give some account of the next great undertaking for which the new organisation is making itself responsible in Turin. This is to be held under the auspices of the Italian Government, and as in the previous cases, is to be of an international character. Than the Valentino Park, no finer site could have been found for such an enterprise, and it is satisfactory to know that in these grounds the British Section is to hold the most commanding position. Turin has a population of 400,000 inhabitants. It possesses the finest armoury in the world, and, in addition, has the advantage of numerous beautiful museums, art galleries and monuments principally in bronze. From a picturesque point of view, few cities could be more delightfully situated. On three sides it is surrounded by the Alps, the Maritime Alps and the Ligurian Appenines, while on the fourth, far into the distance, stretches the fertile Lombardian plain. With such a setting, the Exhibition, which stands at the end of the Corso Vittorio Emanuele II, cannot fail to be attrac tive. The Exhibition grounds extend along both banks of the River Po, and are in the Valentino Park, quite close to Porta Nuova, the Central Railway station. About 500 ft. from the left bank of the river and 35 ft. above it, in a most commanding position at the south-east end of the Park, is the magnificent main facade of the buildings for the British Section, which alone, with part of the Italian Section, stands on the side nearest the city. The front of the buildings takes the form of a crescent, and is surmounted by a central dome with smaller domes supporting on either hand. The British Pavilion has been isolated and rendered practically fireproof. Every precaution has, in fact, been taken both by the Exhibitions Branch of the Board of Trade, and by the Italian authorities, to prevent such another disaster as occurred in Brussels. The space available for occupation by the representatives of British industry within the Section, is 20,000 square metres, and signs are not wanting to show that, however successful were the efforts of the Exhibitions Branch in Brussels, Buenos Ayres and Vienna, the Turin Exhibition is likely to create a record.

Prometheus Cooking.—We have received from the British Prometheus Co., Ltd., a card giving particulars of the electric cooking operations carried out with Prometheus apparatus in the kitchen of the firm's staff dining club. For the week ending October 29th, an oven, two vegetable cookers, a plate-warmer and kettle were in use; 54 diners were supplied with 162 courses, 44·6 units being used, the average cost per person per meal for energy (at 1d. per unit) working out at ½d. The firm intend to issue weekly cards, giving data as to the meals, cost, &c., which should interest everyone engaged in developing electric cooking.

The Lighting of the "Balmoral Castle."—The Royal visit to South Africa has naturally received much attention at the hands of the daily Press, but among the numerous details appearing therein, little mention has been made of the great preparations which were made in order to administer to the comfort of the Duke of Connaught and his suite during their voyage. The lighting of the luxurious saloons of the *Balmoral Castle* was effected by means of tantalum lamps. This is only one of a large number of ship installations proving that the tantalum metal lamp is again favoured for use on steamships. The apartments of a first-class steamship are very similar to those of the latest palatial hotels, and among the many other important details of the voyage to the Cape, no attention has been spared which would tend to bring the electrical installation to the utmost perfection.

Peebles-La Cour Motor-Converters.—An order has recently been placed with Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, for 16 motor-converters of 475 kw. each for one supply company. We understand that this makes an aggregate of 36,700 kw., comprising 76 machines, ordered from the firm since January last.

E

Trade Announcements.—Messrs. E.M.F., Ltd., have opened their new showroom at 212 and 213, Upper Thames Street, London, E.C., where they are showing, amongst other goods, an extensive collection of new designs of electroliers, pendants, brackets and art brasswork, also ship, mill and factory fittings made at their Walsall works, together with electric heating apparatus.

The Felgate Installation Co., of Reading, have opened a branch office at Pembroke Road, Sunninghill.

The Allmanna Svenska Electric Co., Ltd., who are the sole representatives in this country of the Allmanna Svenska Elektriska A.B., of Vesteras, Sweden, have opened offices at Norfolk House, Cannon Street, E.C. The Swedish concern, has to its credit, some of the largest hydro-electric and other installations in the world, and the English branch is prepared to undertake schemes of a similar nature.

Messrs. G. A. Harvey & Co., Lewisham, London, S.E., have recently erected special plant for the manufacture of perforated lead for accumulators and other electrical apparatus.

Messrs. Falk, Stadelmann & Co., Ltd., announce that they have appointed Mr. G. Falk, who has been connected with their business for the past 10 years, as manager of their Glasgow branch, in succession to the late Mr. A. C. Taylor. There will be no change in the representation or general staff.

We have visited the showrooms of Messrs. H. Wittussen & Co., 27, Shoe Lane, E.C., who are specialising in all sorts of glassware suitable for electrical purposes. They are showing a fine selection of samples, many of which are their own specialties. As they specially appeal to the wholesale trade, Messrs. Wittussen will welcome representatives of the wholesale and factoring houses to examine their samples at any time.

Silvertown Belting.—One of the many lines of their business for which The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., have a world-wide reputation is

"Silvertown" belting, both rubber and balata. Quite a large and important contract has just been fulfilled to the order of Messrs. Spencer & Co., Ltd., of Melksham, for the Hull and Barnsley Railway Co. Two large rubber belts (shown in the illustration ready for despatch) are to be used for loading vessels with coal at the Hull Docks by a new patent conveyor system which has already been successfully applied by the North-Eastern Railway Co. for the same purpose, and for which Messrs. Spencer & Co. have the sole rights of manufacture and supply. The plant will be electrically-driven. The belts are 953 ft. and 929 ft. long, and weigh 12,071½ lb. and 11,740½ lb. respectively.

Capital Reduction.—The petition for confirming the reduction of the capital of Robertson Electric Lamps, Ltd., and Reduced, from £100,000 to £35,000, is to be heard in London to-day, November 11th.

Dissolutions and Liquidations.—Telegraph and Telephone Instruments, Ltd.—This company has approved agreements for the sale of its patents and property, made between the company, J. H. Webb and Helsby Wireless Telegraph Co., Ltd., and is accordingly winding up voluntarily. Creditors should send particulars of debts, &c., to the liquidators, Messrs. A. Baker and J. H. Webb, 25, Victoria Street, S.W., by November 23rd.

S.M.H. Tramways Syndicate, Ltd.—A meeting of creditors will be held on November 12th, at 13, St. Helens Place, E.C.

Nye & Co., motor dealers, electricians, &c., 69, Leather Lane, E.C.—Messrs. R. C. Budge, P. J. Budge and R. G. Nye have dissolved partnership, Mr. R. C. Budge retiring. The remaining members of the firm will attend to debts, &c.

Midgley's Electro-Therapeutical Co., Ltd.—This company is winding up voluntarily, with Mr. F. Murgatroyd, 4, Clarence Street, Manchester, as liquidator. The liquidator has authority to sell the business to Chas. Midgley, Ltd. A meeting of creditors is called for November 15th.

Ludw. Loewe & Co., Ltd.—A meeting of creditors will be held at 30-32, Farringdon Road, E.C., on November 18th. Creditors' claims to Mr. G. W. Goodchild, liquidator.

Robson & Coleman, electrical engineers, Haymarket Lane, Barras Bridge, Newcastle-on-Tyne.—This partnership has been dissolved by mutual consent. Mr. Arthur Charles Coleman is retiring from the firm, and Mr. Robert Edward Robson will in future carry on the business.

Catalogues and Lists.—Messrs. Fielding & Platt, Ltd., Gloucester.—Circular showing their suction gas engines and plants and oil engines.

Messrs. Griffiths Bros. & Co., Macks Road, Bermondsey, London, S.E.—Circular giving some particulars concerning their "Ohmaline" air-drying varnish and curves, &c., of insulation and breakdown tests made in 1908 at the National Physical Laboratory.

The British Metal Engraving Co., Ltd., Kingston-on-Thames.—Large postal card (including inquiry postcard) relating to their name-plates.

Messrs. Tetley & Co., Falcon Electrical Works, Bedford Street, Greengate, Salford.—12-page well-illustrated list stating prices of their various "Falcon" water-tight ship and mill fittings for carbon and metal-filament lamps. Surely the printer has adopted a new way of spelling "filament" and "vitreous"!

Messrs. Cookson & Co., 59-61, New Oxford Street, London, W.C.—Several revised trade price lists (November) have just been issued, dealing with accumulator accessories, ignition accumulators, traction batteries for cars and electric launches, plates for ignition and traction work, electric side and tail lamps—all of which they carry in stock.

Messrs. Chas. Price & Son, Broadheath, near Manchester.—12-page illustrated list of their vertical type paraffin and petrol engines, and small one, two, and three-cylinder electric lighting sets.

Messrs. Pritchetts & Gold, Ltd., 58, Victoria Street, London, S.W.—Circular giving tabulated details of rates of charge and discharge, dimensions and prices, of Pritchett 25 and 50-volt accumulators.

Messrs. W. T. Nicholson & Clipper Co., Ltd., King Street, Salford, Manchester.—Booklet containing necessary instructions, with appropriate illustrations, for the working of their "Klincha" belt tool and fasteners. Copies will be sent to any reader interested in belt fastening.

International Time-Recording Co., 151-155, City Road, London, E.C.—80-page booklet entitled "Pictorial evidence," in which appear half-tone illustrations of the Bundy, International, and Rochester, automatic time recorders as they stand in service in various public works, railways, tramways, factories, &c.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—New 16-page catalogue (F 84) giving full descriptive particulars with illustrations, sizes, code-words, prices, and so on, of the "Eclipse" electric heaters. Three new patterns have been introduced, unlike any others on the market so far as we know. Two of them are illustrated elsewhere in this issue. Other patterns are exactly as last season, but in certain cases price reductions are shown.

Messrs. Best & Lloyd, Ltd., Cambray Works, Handsworth, Birmingham.—34-page catalogue (No. 80) of the "Best" electric heaters; some excellent examples of lamp radiators—from two to six lamps—are shown, also a number of non-luminous types of which we published illustrations a few weeks ago. A fine catalogue (No. 79) of close upon 190 pages of electric light fittings has also been issued. This, as the reader will know from what we have already said in these pages, contains a splendid variety of choice designs of brackets, electroliers, drop pendants, candle fittings, ceiling fittings, and so forth. Both catalogues give prices, those in the fittings catalogue being stated in both English and French, as are also the fittings descriptions. These publications are being issued to the electrical trade generally throughout the British Isles, &c.

Messrs. Maguire & Gatchell, Ltd., 7, Dawson Street, Dublin.—Pamphlet describing the "Price" high-efficiency electric heater, which consists of heating coils wound on a sheet-iron tube and surrounded by a second tube, the combination resembling hot-water heating apparatus. It is claimed that on this system the heat is uniformly distributed, instead of forming a column of hot air only over the radiator itself. The temperature of the coil is kept low, and the system is claimed to be ideally simple, effective and cheap. It comes into action directly it is switched on, and is free from the time-lag inseparable from the use of water for heating. The system has been used to great advantage in greenhouses, garages, &c.

The Sunbeam Lamp Co., Ltd., Park Road, Gateshead.—A fine catalogue of 430 pages has been issued by this company, who, as lamp makers at any rate, need no introduction to the electrical industry in either this or any other country. Though the word "Sunbeam" has generally been associated with lamps up to the present, the company has of late widened the scope of its operations, so that in this catalogue lamps occupy only a small proportion of the space, "Everything Electrical" being the idea of the firm in its compilation. The list is very fully illustrated and well arranged; the

different sections are printed in different coloured inks, setting up a sort of sectional relationship between the respective classes of material. It would be vain for us to attempt to enumerate the great variety of manufactures that are here illustrated and priced, but in order that readers who may not yet have seen the publications may obtain a fairly accurate idea of the nature of the contents we give a rough index to the six sections into which it is divided. Section 1, "Sunbeam" carbon and metal-filament lamps and radiator lamps; Section 2, accessories and sundries (switches, cut-outs, switchplates, fuseboards, tubing and fittings, watertight fittings, insulators, &c.); Section 3, power material (ironclad switches, main switches, power fuses, motor-starters, circuit-breakers, transformers); Section 4, electrical instruments (ammeters, voltmeters, portable instruments, testing sets, leakage indicators); Section 5, cables, telephones, bells, indicators, pushes, cells, &c.; Section 6, electroliers and fittings, including hall lamps, standards, brackets, signs, heating apparatus, radiators, shades, &c. The last-named section is the most extensive; it contains a number of advertising sign specialities. Whilst many of the designs follow conventional lines, there are a large number of new patterns of fittings which are more particularly designed for use with "Sunbeam" high-voltage lamps. Amongst the accessories is a new type of flat switch which obviates the use of a wood block owing to the groove in the base, and is therefore cheaper to install. At the end of the book we find occupying many pages a full telegraphic code for everything in the list, including code-words for every description of "Sunbeam" lamps. This section will, no doubt, add to the value of the catalogue to the electrical contractor and buyer.

The Bastian Electric Heating Syndicate, Ltd., 91 to 93, Palmerston House, London, E.C.—List No. 2 just issued is a 22-page pamphlet containing full particulars and illustrations with prices of Bastian (Quartzalite) electric cooking and heating apparatus, including several types of heaters, aluminium heater frames, ovens, hot-plates, table heaters, urns, flat-irons and coffee percolators. A neat showcard is also being issued, the central feature of which is an illustration of the "Quartzalite" "Rat-trap" type. Copies of this card can be obtained by the trade on application to the firm or to any of its wholesale agents, of which there are 13. A report of test recently made by the Westminster Electrical Testing Laboratory testifies that a Bastian type A heater rated at 200 volts and 3·5 amperes, has been run for 4,000 hours on an unregulated commercial circuit, the terminal voltage being from 200 to 210 volts, without any failure taking place, and without signs of imminent failure.

Messrs. James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.—Circulars relating to their "K.B." combined blower and motor.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Price leaflet concerning metallic-filament lamps.

Earthing Regulations.—Commenting on our recent article on "Earthing Regulations in Practice," and a letter on the subject in our last issue, Mr. Sarsfield W. Martyn writes to point out that the "M.P. Wiring System," described in our issue of September 2nd, provides a continuous earth-connected metal sheathing, and that every piece of exposed metal is earthed, while the system is both exceedingly simple and safe, and extremely cheap. He will send particulars to any reader who would like to have them.

Foreign Trade Information.—The handbook to the Commercial Intelligence Branch of the Board of Trade should be in the hands of every firm which is doing export business, for it gives full particulars of the kind of information that is held available by the department. It is only by a study of this pamphlet, or by personal trial of the willingness and ability of the branch to assist, that a full knowledge of the facilities that are available at home and abroad can be obtained. More than this, we think we need not say. The handbook can be bought for 2d. from Government printers, bookstalls, of the department itself, and, indeed, almost anywhere by ordering.

For Sale.—The Belfast Corporation electricity department has for sale a quantity of scrap metal. The Swansea Harbour Trust have for disposal two compound engines and two generators. The G.P.O. has for disposal a quantity of telephone exchange fittings at Glasgow. See our advertisement pages in this issue.

Price Reductions.—Messrs. Siemens Bros. & Co., Ltd., Caxton House, S.W., are advising the trade that owing to the fall in the market price of rubber, they are making a further reduction in the prices of V.I.R. wires and cables. Altered discounts for their October, 1910, interim price list are announced.

LIGHTING and POWER NOTES.

Accrington.—At its meeting, on Thursday last week, the Burnley R.D.C. consented to Accrington Corporation supplying the districts of Altham and Reedley Hallows with electricity for public and private purposes, and decided not to oppose the Council's application to the B. of T. for a provisional order.

Acton.—Our local correspondent writes: "I gather from a reliable source that there are 12 members—exactly one-half of the Council—whose efforts will be directed in strenuous opposition to the handing over of the electricity undertaking to the Metropolitan Electric Supply Co. Locally, the feeling obtains that, in view of what has transpired since the Council's decision, the company will seriously consider the promotion of a Bill in Parliament, particularly in view of the fact that the "blocking" of such a measure is certain. Copies of the resolutions adopted by the ratepayers have already been forwarded to the Government departments, and certain councillors have also interviewed several of the high officials of the B. of T. and placed before them full and complete information respecting the present position of the undertaking." At an emergency meeting of the D.C. on Tuesday, it was decided to obtain the ratepayers' opinion, by means of a post-card referendum.

Ashford (Kent).—The U.D.C., on November 3rd, received from the East Kent Electric Supply Co., Ltd., a request for consent to its application for a provisional order for electric lighting. The Clerk advised the Council to keep a free hand and not to prejudice itself, and eventually the matter was referred to the Lighting Committee. With reference to the rural district, which is under two Councils, certain parishes near Ashford, which are growing largely, were omitted in the statutory notices served upon the R.D.C.'s, as they were thought to be included in the urban area. Both the East and West Ashford Rural Councils have been asked to waive their right of receiving the notices.

Atherton (Lancs.).—A statement having been submitted to the Electricity Committee of the U.D.C., as to the amount spent out of the loan of £10,000, sanctioned in 1903 for electric lighting purposes, the Council has decided to apply to the L.G.B. for sanction to a loan of £5,000 repayable within 25 years, to meet further capital outlay.

Australia.—The Victorian Government proposes to install an electrical plant at the State coal mine at Wonthaggi, at a cost of about £25,000. It is intended to provide power for haulage underground and on a surface tramway running from the brickworks to the mine and the township, for lighting, pumping, and ventilating the mine, and for lighting the town.

A proposal is on foot for the duplication by the Hampden Shire Council (Victoria) of the electric lighting plants at Camperdown and Terang, at a cost of £2,900.

The Mildura (Victoria) Shire Council intends to borrow £3,500 to pay for the existing electric lighting installation at Mildura, and for duplicating the lighting and power plant.

The St. Peter's (N.S.W.) Municipal Council has under consideration the question of the installation of electric lighting.

A public meeting was to be called at Traralgon (V.) to consider a proposal to set up an electric light and power plant at that place. The cost of the work, to provide 275 H.P., is estimated at £2,750.—*Board of Trade Journal.*

Beckenham.—The U.D.C. having applied for sanction to borrow £11,000 for the purposes of its electricity undertaking, Mr. H. R. Hooper, L.G.B., opened an inquiry last week. The clerk said the money was required for mains and services (£5,000), free wiring (£5,000), and meters (£1,000). They had £7,000 under a local Act for free wiring, and £20,000 sanctioned by the Local Government Board, out of which had been spent £24,870 5s. 5d. The total capital sanctioned under the local Act was £38,000 and £107,751 through the Local Government Board, or a total of £145,751 borrowing powers. On general account £116,089 11s. 8d. had been spent. The Inspector asked for details of the figures sanctioned by the Board, and the clerk said that as they extended over a period of 10 years, to ask for them at a moment's notice was unfair.—The Inspector: If we cannot get the figures, we cannot go on with the inquiry; I have no difficulty elsewhere in obtaining the figures of capital expenditure. I want to know the amount of the balance in hand, and how it is arrived at.—The Clerk: You are told here (in a tabulated statement) what the sanctioned capital is.—The Inspector: May I ask you not to argue.—The Clerk: I decline to be dictated to. In the course of further discussion, the Clerk said free wiring did not pay, because of the amount of the loan, and the fact that the repayment was limited to 10 years.—The Inspector said that £27,000 having been spent on free wiring, he thought it was time to see whether the undertaking was a success, and he adjourned the inquiry until he could obtain the details that he required.

The U.D.C. proposes to open a showroom, office, and model kitchen in connection with the electricity works.

Birmingham.—An interesting departure has been made by the Electric Supply Department of the Corporation. This is an exhibition of electrically-driven machinery located in the showroom of the premises at Dale End, which was opened two years ago, but has been enlarged in order that consumers might have greater facilities for instruction in the most efficient methods of applying electricity for motive and other purposes. The display of plant is well up to date, and is arranged to show the operation of the H.T. and L.T. systems for power consumers. The demonstrations, which have been witnessed every day by a large number of business men, will be continued until the 15th inst., and it is intended to follow them up by displays in the use of domestic electrical appliances for cooking.

Canada.—The Montreal Board of Control has decided that the huge electric signs now fixed to many of the large buildings in the town must be removed. During a recent storm a number of these signs were blown down with serious consequences to several passers-by.

Chelmsford.—The wardens of St. Mary's Church propose to install electric apparatus for blowing the organ in place of the present hydraulic power.

Chepstow.—The Gloucestershire C.C. has consented to overhead wires for the transmission of energy being used by the Chepstow E.L. and Power Co., between Castleford House and Sidbury Park, Tidenham.

Continental Notes.—SWEDEN.—On October 29th, the large power plant at Trollhättan, the most famous waterfall in Scandinavia, was inaugurated. The plant, which can now deliver 40,000 H.P., will be finished in 1911, and will then have a capacity of 80,000 turbine H.P., representing a flow of 250 cb. m. per second. When the Swedish lake Vänern is regulated and all the waterfalls utilised, the State will dispose of no less than 180,000 H.P. Up to date the costs amount to 11,300,000 kr. When lake Vänern has been regulated, for which purpose the Riksdag has already granted 22,800,000 kr., a new power canal is to be built with a capacity of 100 cb. m. per second. This regulation includes the rebuilding of the Göta Canal as far as Trollhättan, so as to make direct navigation possible from the North Sea to lake Vänern; the scheme, when accomplished, will be of immense importance to the commerce and industry of western Sweden. About 100 m. below the junction of the two canals is the big flood-gate, the largest in the world. It is 9 m. high, 18·7 m. wide, and weighs 60 tons. The dynamo house is built for eight turbines of 10,000 H.P. each, and direct-coupled three-phase generators of 9,000 K.V.A. The voltage is 10,000—11,000 volts. The generators were built by the Allmänna Svenska Elektr. A.B., at Västeras. The transmission lines have a total length of 122 km., covering a great part of western Sweden.

GERMANY.—A large electric undertaking is contemplated in the province of Pommern, at an estimated cost of 6,900,000 marks. A central station is to be built at Köslin, to supply that district and four neighbouring districts and a portion of four others, the cost being shared by all the districts concerned.—*Annalen der Elektrotechnik.*

A district central station is to be built at Gross Strehlitz, in Schlesien, for the supply of local agricultural and industrial requirements, and also for the working of a railway over the Annaberg mountain to the railway station at Leschnitz.—*Annalen der Elektrotechnik.*

AUSTRIA.—The Austrian State Railway authorities have decided to establish a plant at the railway works at Villach for the generation of electrical energy for lighting and power purposes.

Crompton (near Oldham).—After hearing the report of a deputation which visited Rochdale and Oldham, the Sewage Committee has decided in favour of arc lighting at the Newhey Sewage Works.

Darlington.—At a meeting of the T.C. on the 3rd inst., Mr. Wooler moved the adoption of the report of the Electricity Committee, and referred to the experiment they were making with the lighting of Cleveland Avenue, where four electric lamps had been fixed, each fitted with two 32-C.P. Osram lamps and very effective reflectors. The lamps are switched on and off automatically, and the charge to be made is the same as that for single-mantle gas lamps. Mr. Wooler said he thought it might be found desirable to substitute these for gas lamps. Alderman Bartlett raised a question as to a proposal of the Committee to give a discount of 10 per cent. to consumers for power purposes entering into an agreement for 10 years. They had spent £80,000 on the works, and the profits in nine years had only been £1,800. If they reduced the charge for electricity for power as proposed, they might sell less gas for that purpose. He moved that the matter be sent back for reconsideration. Alderman Barron seconded the motion. The amendment was adopted.

Dewsbury.—The T.C. has decided to extend the mains to supply the premises of the Standard Patent Glazing Co., Calder Dyeworks, at a cost of £325. The Yorkshire Electric Power Co. has asked the T.C. to consent to its supplying current to manufacturers at Ravensthorpe for lighting purposes in premises where it is used for power.

Dundee.—As a result of the alterations subsequent to the last municipal election, Mr. W. Don retires from office as chairman of the Electricity Committee, having been re-appointed a magistrate. We learn that Mr. Don has been of great service to electrical interests, and the result of his influence has been shown in the rapid strides made by his department since he first became chairman. He is succeeded by Mr. J. M. Nairn, who also has had considerable experience on the Electricity Committee.

Dunfermline.—An agreement has been signed by the T.C. with the Fife Electric Power Co., under which the T.C.'s Electric Lighting Order is transferred to the company. The Order may be retransferred to the Corporation at the end of 30 years on payment of the then value of the undertaking.

East Cowes.—The U.D.C. proposes to substitute electricity for the present suction gas plant at the waterworks, and the Isle of Wight Electric Light and Power Co. has been asked upon what terms it will fix a 20-H.P. motor, and the cost of energy. It is thought that the cost of electric power will be only half that of gas.

Felixstowe.—The U.D.C. has asked the Suffolk Electricity Supply Co., Ltd., to reduce the charges for energy for lighting to 6d. per unit all the year round, and to allow reasonable discount to consumers for prompt payment of accounts.

Hove.—Messrs. Handcock & Dykes have been engaged to make an inspection of the plant at Holland Road electric light generating station at the end of the current year, and to report to the Lighting Committee preparatory to the annual audit of accounts, at a fee of £7 7s.

India.—According to *Indian Engineering*, 25 sets of electric train-lighting equipments are being supplied by Messrs. Stone & Co., to the East Indian Railway.

Leyton.—The U.D.C. has decided to apply to the L.G.B. for a loan of £7,000 for a turbine and dynamo with condenser, an additional cooling tower, pipe work, switchboard and accessories.

Limerick.—With further reference to Mr. Clayton's report on the electric lighting undertaking, which was briefly mentioned here last week, the Corporation E.L. Committee last week held its adjourned meeting to consider this report. Mr. P. T. M'Namara, borough electrical engineer, submitted a report in which he denied the accuracy of the adverse conclusions arrived at by Mr. Clayton. According to a report in the *Freeman's Journal*, there was a long and, at times, very acrimonious discussion. Mr. J. G. O'Brien proposed, and Mr. P. Bourke seconded, a motion that Mr. M'Namara be asked to resign from his position, and that a thoroughly qualified man be got to take over the work of the power station, and so save the ratepayers of the city the £35,000 invested in the concern. Alderman Donnellan proposed, and Mr. John Dalton seconded, a direct negative. On a poll 14 voted for, and 12 against, Mr. O'Brien's motion, and the Mayor (who did not vote) declared it carried as a recommendation to the Corporation. No one who read the Limerick note in our last issue will be astonished to hear that the Electric Lighting Committee has recommended the Corporation to ask the electrical engineer to resign.

London.—WESTMINSTER.—The St. James's and Pall Mall E.L. Co. proposes that it be authorised to use the disused flame arc lamps and mains from Regent Street to erect in Piccadilly Circus, say, three steel posts of approved design, in positions to be selected, each post to be, say, 35 ft. in height and to carry four of the lamps. The company offers to provide and erect the posts and the 12 arc lamps, and to maintain them under contract with the Council for a period of five years for the full normal hours of lighting under the terms of the Council's specifications and requirements, free of all charge and cost to the Council. The company expresses the hope that the Council will recognise the *bonâ fide* nature of the offer, which will enable lighting experiments to be continued for their mutual information. The company further offers, in the event of any improved lamp or method of lighting by electricity being introduced during the period of the contract, to change over (by arrangement with the Council) to such a system. The electric arc lamps proposed to be erected in Piccadilly Circus will not be in place of, but additional to, the high-power gas lighting to be provided by the Gas Light and Coke Co. under the new public lighting contract. The Committee has decided (subject to the usual sanction) to accept the offer of the company.

KENSINGTON.—Two 7-H.P. electric motors are to be substituted for the gas engines at present in the Warwick Road Depôt. The approximate cost of the motors is put at £190. The Brompton and Kensington Electricity Supply Co. is to provide the necessary cable for connecting the motors for £9, and it will supply power at 1d. per unit.

Newcastle Emlyn.—The ratepayers at a meeting on Thursday night considered the offers made by the Electric Light Co. to the District Council for lighting the streets with electricity, and though no resolution was adopted, the majority of those present were in favour of the offer made to light the urban area each night during seven months of the year, rather than that for the whole year.

Ottery St. Mary.—Messrs. Purves & Co., of Exeter, who are about to carry out an E.L. scheme for the town, have applied to the U.D.C. for the exclusive right to erect poles in the streets for carrying overhead wires. The Council on November 3rd referred the matter to a Committee.

Port Clarence.—Extensions are being made to the electrical equipment at the Haverton Hill Wells belonging to the Salt Union, Ltd., of Port Clarence, in the area of the Cleveland and Durham Electrical Power Co. The company is putting up a new overhead line with three cables at 2,750 volts for the purpose of supplying these wells. At the further end of this pole line new sub-station plant is being installed in the existing building. This consists chiefly of three transformers which are controlled by switchgear of the pedestal type on the H.T. side, and protected by fuses of the Reyrolle type on the L.T. side. The current is employed at the wells for the centrifugal reservoir and well pumps, which are driven by three-phase motors. The motors are of the Westinghouse type.

Rhondda.—In connection with the Welsh colliers' strike, several thousand men last week stormed the Glamorgan Colliery, overpowering the police, in order to take possession of the colliery power plant, with a view to preventing further use of the underground machinery. Although the attack failed, a state of siege has since been maintained.

Grimsby.—In regard to the contract with the T.C. for the supply of electricity to the Great Central Railway Co., which expires on the 23rd inst., a new agreement is to be entered into for the continuance of the supply to June 30th, 1911.

Selby.—The U.D.C. on November 2nd decided to ask the B. of T. to extend the Council's E.L. order for three years, the Board having written intimating that no steps had as yet been taken in the matter.

Settle.—The question of the advisability or otherwise of having an electric lighting installation at the Settle (Yorks.) Hospital came before the D.C. last week and was deferred. The Lighting Sub-Committee recommended the Council to adopt electricity, and upon a question being raised as to the cost, it was stated that the installation would mean the expenditure of about £200.

Siam.—The Siam Electricity Co., Bangkok, has obtained a concession from the Siamese Government for introducing electric light in the capital, on the west side of the river.—*Commercial Intelligence.*

South Africa.—The East Rand Mines Co. recently commenced the construction of new air-compressor and electric generating plants on a large scale. A 3,000-KW. Willans-Dick, Kerr turbo-alternator was installed, and this is now being supplemented by a 6,000-KW. set by the same makers, for supplying three-phase current at 3,150 volts and 25 cycles. Willans surface-condensing plants have been provided in both cases.

Stevenage.—Mr. W. R. Walton, of Manchester, has informed the U.D.C. that he has applied to the B. of T. for an extension of time of six months for carrying out the E.L. order.

Stoke-on-Trent.—The T.C. has decided to lay another feeder from the Burslem Works to Newport Lane in order to provide a duplicate supply for large power users, at a cost of £1,000.

Power consumers have been asked to relieve the motor load as far as possible during the peak load in the winter months, viz., 4 to 6 p.m.

Stourbridge.—Ironworks at The Lye, Stourbridge, which have been taken by a Bilston gentleman, are to be electrically equipped for the rolling of small iron rounds and light steel sections.

Stretford.—Mr. T. L. Miller has been reappointed by the U.D.C. as consulting engineer to the electricity undertaking, at a fee of 25 guineas, to cover the following services:—(*a*) Such conferences as may be necessary from time to time with the Committee, or its chairman or engineer; (*b*) preparation and submission of quarterly reports on the working of the station and condition of the plant.

Tasmania.—The proposals of the Complex Ores Co. (Melbourne) in regard to utilising the Great Lake for the production of power, include the installation of units of 5,000 H.P. at the power station and the erection of metallurgical works. The estimated outlay is £200,000 for the first unit of the power plant, headworks, transmission and metallurgical works. If necessary, 100,000 H.P. could be obtained from the lake, or more than sufficient for the industries and railways of the State.

Walsall.—The Electricity Committee of the Corporation has received an intimation from the L.G.B. that the proposals of the Committee with respect to the proposed loan of £23,225 for extensions are generally satisfactory, and that, on being supplied with an amended estimate, it will sanction the loan.

The details of the agreement with Messrs. Lambert Bros. (Walsall), Ltd., to supply current to the new works in Green Lane have been approved.

Wellington (Somerset).—At a meeting of the U.D.C. on November 3rd, it was reported that certain alterations, which would be for the benefit of the town, had been made in the terms of the prov. order being applied for by Messrs. Purves, of Exeter. The Council deferred its decision pending further consideration of the matter in Committee.

Winchester.—The T.C., on November 3rd, decided to apply for an Act of Parliament to enable the Council to purchase the undertaking of the E.L. and Power Co.

Wolverhampton.—The annual report of the Corporation Electricity Committee to the T.C. contains the following statement of units sold during the year ended June 30th, 1910:—

	Lighting.	Power.	Traction.	Total.
Year ended June 30th, 1910	1,304,768	6,226,152	1,488,608	9,019,528
Corresponding period last year	1,244,612	4,135,169	1,471,632	6,851,413
Increase	60,156	2,090,983	16,976	2.168,115

Mr. H. R. Hooper, L.G.B. inspector, on Tuesday held an inquiry into an application by the Corporation to borrow £20,925 for the purposes of the electricity undertaking. The town clerk explained that out of the proposed loan it was intended to pay £1,425 for land, an agreement having been virtually arrived at by correspondence. The term asked for was 60 years, with repayment out of revenue. For the extensions at the electricity works the sum of £19,500 was asked, this including the following items: Additional plant at Commercial Road station, £10,835; additional buildings and plant at refuse destructor, £4,200; new workshops and equipment, £1,850; for services to consumers' premises, &c., £1,000; over-expenditure on a loan of £20,000 sanctioned November, 1907, £807 7s. 11d.; contingencies and miscellaneous items, £807 12s. 1d. The present capacity of the works was 4,640 KW., and the maximum load in 1909-10 was 3,880; and after allowing for spare plant there was a deficit of 740 KW. Evidence having been given by Mr. C. E. C. Shawfield, the electrical engineer, and others, the Inspector remarked that the capital of the electricity undertaking was getting rather heavy. He struck out the sum of £1,000 charged for services to consumers' premises. The Inspector also said that when, as seemed likely in about 12 months' time, another application was made for power to extend the boiler house, anything else that was wanted for the concern might then be embodied. As the result of a conversation, amended figures were submitted as follows: Additional plant at Commercial Road, £9,600; refuse destructor, which was £4,200, increased to £4,650; application for £1,850 in respect of new workshops and equipment withdrawn pending further consideration. The Inspector intimated that any amended plans submitted would be granted without the necessity for further inquiry. The sum of £1,000 for consumers' services, as stated, was struck out; £807 excess expenditure on loan withdrawn; and £807 for contingencies was reduced to £400.

Worcester.—The Electricity Committee, in its efforts to make the city electricity undertaking pay, has come into conflict with local electricians. The Committee proposed to establish a sales department, and to act as agents for manufacturers of heating and cooking apparatus, and motors. When the proposal came before the Corporation, it was referred back to the Committee for further consideration. The Committee had a conference with local electrical contractors, and on the Committee's behalf it was stated that it did not purpose to undercut the local tradesmen and agents. It was suggested that members of the Committee should meet representatives of the electrical industries with a view of fixing terms on which motors and other appliances should be sold by the electricity department, so as to prevent unfair competition. The representatives of the electrical trades refused to recognise any form of trading by the Electricity Committee, and they stated that they should oppose, through their trades' association, any act of the Committee which could be construed into trading. The Committee eventually resolved, by the casting vote of the chairman, to ask the Corporation to allow the electricity department to pass on to local contractors, or to manufacturers of heating and cooking apparatus, and motors, any orders obtained, and to charge a commission at such a rate as will prevent undue competition with traders already selling such apparatus, but on the distinct understanding that the department does not undertake the sale of fittings or lamps, or the wiring of houses, and that the Council is not to be liable for the price of the goods sold. The proposal was to come before the City Council on Wednesday.

Wrexham.—The T.C. has passed a resolution in favour of the promotion of the Bill of the I.M.E.A., seeking powers for local bodies to supply fittings and to do wiring work.

TRAMWAY and RAILWAY NOTES.

Bingley.—On Tuesday evening a special meeting of the District Council was held, when resolutions were passed proposing certain conditions in reply to a suggestion from the Keighley Corporation that the latter should run cars through Bingley on the trackless system. The Council adopted a resolution that the application of the Keighley Corporation for the Council's permission to the running of such cars be not entertained for any term exceeding 14 years, and that the Council grant the Corporation the privilege of running such cars on its present motor-omnibus route for a period of 14 years on the conditions that a payment of £350 a year be made for wayleaves; that the same fares per mile be charged as in Keighley; and that the Corporation supply electricity in bulk to the Council, if required, at the lowest rate, and subject to such conditions on other matters as might be agreed upon between the Council and the Corporation. The chairman made a statement that a Sub-committee had considered the question, and came to the conclusion that the present moment would be inopportune for the Council to provide trams or electricity for itself.

Continental Notes.—GERMANY.—A scheme for the construction of an electric railway between Wesel and Emmerich-Huthum, a distance of about 28 miles, is at present under consideration.

Some experiments with electric traction are about to be carried out on the Lanhan-Dittersbach section of the Prussian State Railways in Silesia.

Plans are being prepared in respect of a projected electric tramway between Sosnowice and Misslowitz, Silesia.

A fresh instance of municipal co-operation with private enterprise in Germany is represented by the formation of the Upper

Rhenish Railway Co. by the South German Railway Co., the New Rheingau Electricity Co., the Rhenish Schuckert Co., the South German Discount Co., and the City of Mannheim. The object of the new company is to establish a network of suburban electric lines around Mannheim, and the sphere of activity comprises southern Hessen, the north of Baden, and, indirectly, the Rhenish Palatinate. The working capital amounts to £400,000, and the City of Mannheim, which has assured itself of 51 per cent. of the share capital, has undertaken to guarantee a loan of £800,000. It is intended that the undertaking shall be managed by one representative each of the South German Railway Co. and of the Rhenish Schuckert Co.

ITALY.—The *Bollettino Finanze, Ferrovie* (Rome), of September 22nd, notifies that the Italian Public Works Committee has approved an application for a concession for the construction and working of an electric railway from Argegno to Lanzo d'Intelvi.—*Board of Trade Journal.*

Brighton-Worthing.—It is stated that the promoters of the tramway scheme between these towns intend to proceed with their Parliamentary application. The Hove T.C. is strongly opposed to the idea.

Devonport.—The Tramways Co. has applied to the B. of T. for an extension of time of two years for completing the light railway. The T.C. will offer no objection.

Haslingden.—The B. of G., on November 3rd, approved of an agreement referring the dispute between the Assessment Committee and Accrington Corporation respecting the assessment of the tramways, to arbitration. Mr. Woolley (Accrington) said the good spirit in which the question was being met was illustrated by the fact that, in any event, the costs of the arbitration would be divided between the Corporation and the Union.

Hull.—Parliamentary powers for extending the tramways in the city are to be sought by the T.C.

India.—It is stated that the Darjeeling-Himalayan Railway contemplates the electrification of its line; it is suggested that the presence of water-powers in the neighbourhood will facilitate this.

Japan.—A syndicate is reported to have applied to the Japanese Government for a concession to construct and work an electric tramway between Kudan and Meijiro, a distance of about 3 miles.

Liverpool.—The Corporation has instructed the resident electrical engineer to proceed with the construction of further new cars for the tramway service during 1911, at the rate of approximately one each month.

Marsden (near Huddersfield).—The Clerk to the U.D.C. has been instructed to write to the Huddersfield Corporation requesting that when the latter applies for provision for the extension of its tramways, Marsden shall be included.

Nottingham.—Mr. Walter Gath, the city auditor, in his annual report on the tramway undertaking, says that the reserve fund stands at £62,256. In view of the fact that the permanent way is now very much in need of relaying, the capital outlay on construction being £230,225, and assuming the renewal to cost half this sum, it will at once be seen that £62,256 will not provide two-thirds of the outlay required. The unwisdom of the policy of taking away such a large proportion of the profits (£5,150 was contributed this year in aid of the rates) is quite apparent, especially when complaints are made that the charge for electrical energy is too high. The Finance Committee, in its comments upon the auditor's report, says it does not propose to deal with Mr. Gath's observations on matters of policy—that is the business of the Council, and not the affair of the auditor.

Plymouth.—The tramway manager is to obtain further particulars respecting patent trolley reversers, and is to submit an estimate as to the cost of applying the apparatus to the tramways.

Quarry Bank.—The Tramways Committee of the Brierley Hill U.D.C. has received from the Light Railways Committee a letter enclosing copy of a communication from Messrs. Hawtayne & Zeden, wherein the latter mentioned that they were pursuing the light railways question, and hoped to be in a position at an early date to reopen the matter.

Rawtenstall.—The result of the six months' working of the through running arrangement of the Rawtenstall and Accrington cars has just been calculated by Mr. Stewart, electrical engineer, Rawtenstall. He states that the Accrington cars use 1·18 units per car-mile, and the Rawtenstall cars 1·01 units, representing a saving on the Rawtenstall cars of 17 per cent. as against the Accrington cars. This means that Accrington will have to pay Rawtenstall £100 per year for difference in the current used. He adds that by the through-running arrangement they are practically saving one set of men, though there is no actual saving in current. Both Rawtenstall and Accrington are willing to run more through cars, but Haslingden is not agreeable at present.

Rochdale.—On the 3rd inst. Lieut.-Col. Druitt, of the B. of T., held an inquiry at Rochdale into the application of the Corporation to construct a double line of tramway in Whitworth Road from St. James' Church to Rope Street. It was stated that since the cars were run to Whitworth the traffic on that section had increased by 100 per cent., and when they extended the service to Bacup, as was contemplated, it was expected the traffic would increase still more.

Colonel Druitt was present when the first electric car was run along the new street in Rochdale from the Esplanade to the bottom of Blackwater Street, and sanctioned the immediate commencement of a regular service of cars. The new street, which has been constructed in the heart of Rochdale at a cost of about £12,000, has been equipped with a double line of tramways.

Rotherham.—After many months of consideration, the Corporation has sanctioned an alteration in the arrangements for cheap fares for workpeople; in future, weekly tickets are to be issued on all sections at a reduction of 33⅓ per cent. upon the ordinary fares and single tickets at half-price before 8 o'clock in the morning.

South Africa.—KRUGERSDROP (TRANSVAAL).—It is proposed to construct tramways, which will be run by Edison-Beach storage batteries.—*British and South African Export Gazette.*

Wolverhampton.—From the annual report of the Chairman of the Corporation Tramways Committee to the Town Council, is taken the following statement of traffic receipts, &c., for the first six months of this financial year, ending September 30th last, as compared with the same period last year:—

	Miles.	Passengers.	Receipts.	R.P.C.M.
1910	565,844	5,369,516	£24,916	10·568
1909	494,104	4,647,667	£21,726	10·553

From the above figures it will be seen that the total revenue for the period referred to above shows an increase of £3,190 or ·015d. per car-mile. The car-mileage also increased by 71,740.

During the recent summer, the report adds, the traffic receipts have been considerably increased by special events taking place in the town, the principal of these being the aviation meeting in June last and the charity carnival in August.

U.S.A.—According to *Electric Traction Weekly*, the New York, New Haven and Hartford Railway has contracted with the Westinghouse Co. for the electrification of the Hoosac tunnel, which is 4¾ miles long, and approaches, making seven miles in all. Three Westinghouse turbine units, each of 5,000 H.P., with Le Blanc condensers, will constitute the power plant.

TELEGRAPH and TELEPHONE NOTES.

All-Red Cables.—Writing to the *Standard* regarding the rumour published in that journal to the effect that the Atlantic cable companies were forming a trust, Mr. G. G. Ward, general manager of the Commercial Cable Co., states that his company is not in combination with, and will not combine with, any other cable or telegraph company for the purpose of monopolising the Atlantic cable business, but will maintain its independence and render a competitive service. Further, the Postal Telegraph Co. of the U.S.A., which is controlled by the Commercial Cable Co., is, and will continue, to be the strongest competitor of the Western Union Co. and its allies.

Wireless Telegraphy.—The Aberdeen Line steamships on the Australian service are being fitted with Marconi wireless installations and submarine signalling apparatus.

Japan.—The laying of a new submarine cable between Tanisui and Nagasaki, a distance of about 655 miles, has just been completed.

Post Office Telegraphs.—The annual report of the Postmaster-General for the year ending March 31st, 1910, shows that 86,884,000 telegrams passed over the Post Office wires during the year, an increase of 2·4 per cent. Of these 70,422,000 were ordinary, 4,465,000 Press, 10,259,000 foreign, 1,307,000 railway, and 431,000 Government (free) messages. The receipts amounted to £2,769,053, of which £2,170,896 was for ordinary, £145,339 for Press, and £452,393 for foreign telegrams. During the year 214 additional telegraph offices were opened, the total in the United Kingdom now being 11,291 Post Office stations, and 2,419 at railway stations, &c.

Keyboard perforators have been found of great utility in conjunction with the Wheatstone automatic system, and printing telegraph apparatus is receiving special attention. Undulator apparatus has been successfully tried on the Bristol-Cork circuit, with a view to avoiding the use of repeaters on submarine cable circuits.

The main underground telegraph line to the West has been completed, and the wires between London and the landing places of the important cables starting from the West of England have been diverted to the underground route. The northern underground line has been laid as far as Edinburgh, the second London-Birmingham cable has been completed, and various other underground connections have been established between important centres. During the present year the work will be continued, and will result in a triangle of underground lines between London, Birmingham and Bristol, with extensions from these points, thus providing alternative routes round the sides of the triangle.

The foreign telegrams dealt with show an increase of about 838,000. Quadruplex working on the Baudot system has been introduced experimentally on two of the Anglo-Netherland wires, with

successful results, and it is proposed to make the arrangement permanent. The examination of codes submitted, to the number of 181, is approaching completion, and certificates will shortly be issued in favour of those which comply with the prescribed standard. On January 1st, 1911, the Anglo-Norwegian Telegraph Service will be acquired by the two Governments; a new cable will be laid between Newbiggin and Arendal, the joint property of the Governments, and the rate will be reduced from 3d. to 2½d. per word.

During the year the Post Office acquired from the Marconi Co. and Lloyd's their coastal wireless stations for £17,400, the purchase price including the right to use the Marconi patents free of royalty for 14 years, and the Marconi Co. and Lloyd's cancelled the agreement made between them in 1901, which had tended to impede the development of wireless telegraphy. There has been a substantial growth in the business since the acquisition of the stations, and there is every prospect of a still more rapid extension. New stations will be provided round the coast, and shipowners are advised to proceed with the equipment of their vessels. The number of radio-telegrams dealt with by the Post Office was as follows: Outward to ships, 3,266, as compared with 1,817; inward from ships, 27,727, as compared with 22,732 in 1908-9. During the year 60 licences, covering 79 wireless installations, were granted, all but one for experimental purposes. At the end of the year there were six commercial licences (eight stations), five for private business (11 stations), 164 experimental (242 stations), and 93 minor cases. Licences had been granted to shipowners, covering 130 ships, mainly Atlantic liners.

On the trunk telephone lines, 26,566,318 conversations took place inland, an increase of 3,064,294; the gross revenue was £662,845, averaging 5·99d. per conversation, and from Continental calls £24,135 was derived. There are 643 trunk-line exchanges (45 increase) and 2,666 circuits.

During the year 127 P.O. telephone exchanges were opened in the provinces—100 in England and Wales, 16 in Scotland, and 11 in Ireland. The majority of the provincial exchanges yield no profit at present, but are expected to justify their existence in the future. The P.M.G. has arranged with the National Telephone Co. to proceed with extensions in the outlying parts of areas served by their system. In addition to the exchanges mentioned, 62 public call offices with full facilities, and 39 rural call offices, with limited facilities, have been opened. The total number of lines connected with the Post Office provincial exchanges on March 31st was 23,635, and the exchange telephones rented were 33,330, compared with 30,937. The Glasgow telephone service is being reorganised and consolidated. The only remaining municipal exchanges are Guernsey (1,848 stations), Hull (2,931) and Portsmouth (2,514). On the London Post Office telephone system there were at March 31st 64,200 telephones, an increase of 9,075, and new subscribers were being connected at the rate of 150 per week. There were 766 call offices, 479,899 miles of underground wire, 137,107 miles of wire rented by the National Telephone Co., 163,389 miles of subscribers' lines and junction lines, and 128,054 miles of wire available for the development of the system. The length of underground wires increased by 32,102 miles. About 70 million calls were recorded, an increase of over 15 millions. The amount of royalty received from the National Telephone Co. was £317,807, and from other licensees £2,783. About five million messages were telephoned for transmission as telegrams, and 163,400 for transmission as express letters; 2,154,000 telegrams were delivered by telephone. Rentals of private wires brought in £204,278. A considerable demand has arisen for wires in connection with fire-alarm systems, electric clocks, and telewriter installations.

The total mileage of the Post Office wires, including spares, is now: public telegraphs, 310,039; telephones, 601,980; private and leased wires, 258,106—total, 1,170,125. Of these 428,570 miles are aerial, 731,514 underground, and 10,041 submarine.

The telegraph revenue of the year was £3,166,192, an increase of £67,740; the expenditure, including interest on the purchase price, was £4,182,559, an increase of £37,350, leaving a net deficit of £1,016,367.

The telephone revenue was £1,711,967, an increase of £183,012, and the expenditure, including repayment of capital, was £1,783,940, an increase of £208,945, leaving a net deficit of £71,973. The capital expenditure on the trunk telephone service at the end of the year was £5,596,756, an increase of £913,960. The total capital expenditure on the telephone services amounted to £10,138,128.

On Tuesday last the new General Post Office building in King Edward Street, E.C., was opened for public business.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—The Great North of Scotland Railway Co. invite tenders for stores, including electric lighting material. T. S. Mackintosh, Secretary, Guild Street, Aberdeen.

Australia. — November 19th and 22nd. Telephone cable and testing instruments, for the P.M.G.'s Department. See "Official Notices" October 7th.

N.S.W.—November 16th. Telephone, telegraph, and electric light material, for the P.M.G.'s Department in New South Wales. See "Official Notices" October 21st.

January 4th, 1911.—Three multiple switchboards, for the P.M.G.'s Department in New South Wales. See "Official Notices" November 4th.

November 23rd.—Cable, ironwork, pipes, conduits, switchboards, telegraph and telephone instruments, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" September 30th.

December 29th.—(*a*) Telephone cable, (*b*) battery and line material and instruments, for the P.M.G.'s Department in South Australia. See two "Official Notices" November 4th.

February 6th, 1911.—Arc lamp carbons, for the Sydney Corporation Electricity Department. Specifications, City Electrical Engineer, Queen Victoria Markets, Sydney.—*Australian Mining Standard.*

Austria.—November 20th. The Austrian State Railway authorities in Cracow are inviting tenders for the establishment of electric lighting plants at the railway stations at Rzeszow and Rzeszow-Staroniwa.

Bispham-w.-Norbreck.—November 21st. Gas producer and electrical plant for the proposed generating station, for the U.D.C. See "Official Notices" November 4th.

Bootle.—November 17th. For supplying and fixing a complete installation of electric light at the new Balliol Council Schools. Specifications from the Borough Electrical Engineer.

Bradford. — November 12th. General stores for the Tramways Department of the T.C. for a year; Tramway Offices, 7, Hall Ings (returnable deposit of £1 1s.).

Chatham. — November 17th. Incandescent electric lamps for the T.C., for a year from January 1st; C. Day, Borough Surveyor, Town Hall.

Colwyn Bay.—November 12th. Switch panel, including switches and instruments, for the U.D.C. See "Official Notices" October 28th.

Egypt.—November 30th. According to *African Engineering*, the latest date for sending in tenders for the water filtering and electric lighting plant required by the Egyptian Government for Beni-Souef is now November 30th.

Gateshead.—November 24th. Arc lamp carbons (Form 25), electric lamps (26), electric wires and cables (27), electric light sundry fittings (27*a*), and glasses for electric arc lamps (33*a*), for a year from January 1st, for the North-Eastern Railway Co.; E. H. Clark, Stores Superintendent, Gateshead.

Hull.—November 15th. Unwashed slack for the Corporation electricity works, for 6 or 12 months (6 months, about 11,500 tons; 12 months, about 22,000 tons); Electricity Offices, Sculcoates Lane.

India. — December 1st. Overhead electric and hand travelling cranes, with rails, conductors, motors, &c., for the Cossipore station and sub-stations of the Calcutta Electric Supply Corporation, Ltd. See "Official Notices" to-day.

Invercargill (New Zealand). — January 9th, 1911. Power-house plant, cars, rails, overhead material, wires and cables, poles, &c., for an electric trolley system, also street-lighting plant, for the Corporation. See "Official Notices" October 14th.

London.—L.C.C.—December 6th. Ash-dust removing plant, for the East Greenwich generating station. See "Official Notices" October 28th.

December 6th.—Overhead electrical equipment for tramways between Putney Bridge and Wandsworth High Street. See "Official Notices" to-day.

BETHNAL GREEN.—One thousand 100-volt, 22-c.p. metallic-filament lamps, for the Board of Guardians. See "Official Notices" October 28th.

November 19th.—The Port of London Authority is inviting tenders for supplies for 12 months, including electric light carbons, incandescent electric lamps, glass and glassware, asbestos goods, &c. Manager, Stores Department, 106, Fenchurch Street, E.C.

At the meeting of the Metropolitan Asylums Board on Saturday it was reported that the engineer-in-chief had gone into the matter of the alterations required to the electrical fittings necessitated by recent regulations under the Factory and Workshops Act. The work as regards the laundry is estimated to cost £112, and as regards the workshops, &c., £265. Tenders are to be obtained from a selected number of firms to carry out the alterations.

South Africa.—The *British and South African Export Gazette* states that the Town Council of Queenstown, Cape Province, is inviting tenders for an up-to-date electric light installation for the town.

Southampton.—2,000 radiator lamps, for the Corporation Electricity Department. See "Official Notices" November 4th.

(Continued on page 792.)

SEBASTIAN ZIANI DE FERRANTI,

President of the Institution of Electrical Engineers.

In the case of most men who have become famous, the successes of their lives have been achieved when they were of mature age. The infant prodigy, except in music, seldom achieves lasting fame. Certainly in science the great advances are usually the product of the years of maturity. In electrical science, however, the impression seems to be current that the pioneers have mostly been young men. But Volta was 55 years old when he announced the invention of the voltaic cell; Faraday was 40 when he discovered magneto-electric induction, and 54 when he made his great discovery in magneto-optics; Edison was 30 when he invented the phonograph, and 32 when his carbon filament was produced; while Swan, his rival in the discovery of the glow-lamp, was 51. Davy, it is true, was only 23 when he discovered the carbon arc; Hertz was 30 when he demonstrated the existence of electromagnetic waves; and Lodge was 43 when he publicly showed the wireless transmission of signals. But there are exceptions to every rule, and the man whose work is now to be reviewed furnishes a notable instance.

Sebastian Ziani de Ferranti was born in Liverpool on April 9th, 1864, and is, therefore, still in the prime of life. He was educated partly at Hampstead School, partly at St. Augustine's College, Ramsgate; and for a twelvemonth attended University College, London, when, at the age of 16, a change in family circumstances cut short his educational courses, and he embarked on an industrial career. While yet at school he had shown an unmistakable bent toward engineering. At 12 years old he, like all practical boys, had shown a passion for locomotive engines; and when scarcely 15 he had fitted up his school with electric bells, the pushes for which, and not a little more, were of his own handiwork. In the summer of 1880, when living with his family in Camden Square, N., he built for himself a complete little dynamo, on the lines of the horizontal Siemens dynamo of those early days. What part this exercise played in determining his future career is not known, but within three months he was engaged in the works of Messrs. Siemens Bros., at Woolwich, at a salary of 20s. a week. Behold him, then, embarked professionally as an electrical engineer, at the age of 16, and in the establishment best adapted by its associations and prestige to bring out the latent genius of the lad. It will be remembered that just at that date the shunt-wound continuous-current dynamo was making its *début*; that the alternator of Siemens (designed by von Hefner) was a novelty; that arc lighting, at the hands of Jablochkoff, Brush, Brockie and Crompton, was making its way; and that the glow lamps of Swan, Edison and Lane-Fox were opening out new possibilities in lighting, and demanding new appliances and methods for the public supply of electric current. At Siemens's works young Ferranti was in the heart of the movement, But he was not long to remain an employé. He had ideas of his own to develop, and his sojourn in the Siemens establishment came to an end before two years had passed. In July, 1882, there was filed in the Patent Office by S. Z. de Ferranti and Alfred Thompson a specification for a new type of machine for generating alternating electric currents. In lieu of the bobbins of insulated wire or metal ribbon set around the periphery of a wheel, as in the older machine of von Hefner, the inventors employed a copper conductor of zig-zag form bolted firmly to the wheel. This was the celebrated Ferranti alternator. To the dismay of the inventors, they had barely filed their description when they discovered that Sir William Thomson (Lord Kelvin) had himself a few months earlier secured protection for a machine of similar type, though he had not worked out the construction as the younger patentees had done. An amicable arrangement was entered into, and for some years royalty was paid to Lord Kelvin on every Ferranti machine. The simplicity of the construction, and the very low resistance of armatures of this design, enabled these machines to be worked with greater horse-power, and to yield a corresponding larger output of electric power than any existing machines. An article on the subject in the *Times* of September 16th, 1882, drew general attention to its merits. The *Financier*, of September 18th, announcing the registration of the new firm "Ferranti, Thompson & Ince, Ltd.," with a privately subscribed capital of £240,000, to manufacture the new machine, stated: "We are assured that this machine has already given results equal to *five* times that of any existing machine." This statement was subsequently explained to mean that, as compared with any existing machine of the same size and weight, it would absorb five times as much power and turn it into its equivalent of electric light. An article in *Engineering*, of December 1st, 1882, describing the Ferranti machine then installed in one of the arches under Cannon Street Station, enables one to recall that it ran at 1,900 R.P.M., and had a frequency of 254 cycles per second; worked at 125 volts; yielded 156 amperes, lighting 300 Swan lamps; weighed, complete, 1,500 lb. (or about 76 lb. per kilowatt); and took about 26 H.P. to drive, therefore having an efficiency of about 86½ per cent. The price was given as £250, that is, about £12 per kilowatt. Two other forms of dynamo-electric machine were designed that autumn by Mr. Ferranti; one a small two-pole continuous-current dynamo, familiarly known as "the rabbit"—with the exciting coils almost enclosing the armature, as in Eickemeyer's design; the other a commutatorless "unipolar" dynamo, on the plan later utilised in the mercury meter. By March, 1883, after some two-score machines had been completed, a larger one, to run at 300 R.P.M. and consume 123 H.P., was made; and within a couple of years a 500-H.P. size was attained. The destination of this machine was the scene of a new electrical enterprise, the Grosvenor Gallery lighting station. Early in 1884, Sir Coutts Lindsay, the proprietor of the Grosvenor Gallery, with whom were associated the Earl of Crawford and Lord Wantage, had sought powers to light the picture gallery and at the same time to supply the neighbouring shops in Bond Street. Excavating the cellars double deep, the boilers, engines and dynamos were duly installed, and Mr. Ferranti found himself the engineer to a pioneering enterprise in the public supply of electrical energy. No sooner was this enterprise begun than the need for accessories and appliances of all kinds began to be felt. Were meters wanted? Then Mr. Ferranti must design them. Were switches required? Then Mr. Ferranti must improve on the flimsy patterns hitherto supplied. Were alternating-current motors desired, then Mr. Ferranti must try to put into practical form the suggestions of M. Borel or of Mr. Arthur Wright. Amongst the matters which date from this period is the use of edge-strip coiled copper, first applied in the Ferranti meter, and adopted by Brown for the field-magnet coils of alternators.

But the Grosvenor Gallery enterprise was destined to have a chequered history. Cramped within narrow cellars, in an expensive situation, and close to fashionable residences, where the inevitable noise of machinery, and the cartage of coals and ashes, were regarded as a public nuisance, it was soon found to be an unsuitable centre, though the overhead mains which radiated from it toward Piccadilly Circus on the one hand, and toward the Marble Arch on the other, demonstrated the demand that had sprung up. Mr. Ferranti was not slow in grasping the larger features involved in the problem. Down to that time electrical engineers had talked, as some electrical engineers still talk, of a "central" station. Ferranti perceived that to place a generating station in an expensive centre was a wrong principle; that it ought to be eccentric rather than central, situated outside or on the edge of the supply district, on some cheap site where coal could be cheaply supplied by railway or water, and where large engines and large generators could be grouped together to effect the necessary economies of management and supervision. But this placing of the generating station outside the area of supply involved another consideration of which electrical engineers had had little thought and less experience, viz., the employment of high voltages in the generators and in the mains or cables by which the electric currents were distributed. Pushed a

little further, the problem resolved itself into one of transmission and transformation—and the alternating-current transformer was a tool with which the electrical engineer had hitherto had no familiarity. Further, the cable makers accustomed only to work for low voltages or small currents regarded a pressure of 1,000 volts with something like horror. When, therefore, Mr. Ferranti developed a mighty scheme to erect at Deptford, 6 miles from his distributing area in the West End, a generating station with engines and generators of 10,000 H.P., transmitting current at 10,000 volts to sub-stations within the supply area, where transformers would reduce the pressure to a lower voltage for distribution to the consumers, the daring nature of the proposals made the steady-going engineers look aghast. Such proposals were dangerous and revolutionary. After experience with a few tens or hundreds of lamps to jump to a scheme to supply hundreds of thousands; after working at 100 or 200 volts to rise to 10,000, required an unusual amount of courage; and to supply an area as large as that supplied by the largest gas company, by a network of electric mains, so as to put the distribution of electricity on a footing comparable with that of the distribution of gas, was indeed a very great undertaking. Yet Mr. Ferranti proceeded with firm confidence, and in spite of adversities in the Grosvenor Gallery enterprise, the breakdowns of plant, the fires in consumers' houses, the harassment of litigation for creating a nuisance, he pursued his great project. To the credit of all concerned, he was splendidly backed up by his financial supporters, and in 1888 the London Electric Supply Co. was formed with a subscribed capital of £375,000. But there was one serious difficulty in the way. The use of transformers to reduce the electric pressure at the sub-stations was claimed as a monopoly under the fantastic patents of Gaulard and Gibbs, and this monopoly threatened the project. Ferranti, with his usual determination, claimed from the Courts, and obtained, the revocation of the Gaulard patents, and the revocation was afterwards confirmed on appeal. On April 10th, 1888, the work of constructing the Deptford station was begun. There was a first boiler-house 195 ft. by 70 ft., and two engine houses each of nearly the same size, with an aggregate output of 13,000 H.P., intended to be increased eventually to 65,000 H.P. The first alternators were to be of 2,000 H.P.; but two were designed to follow them of 10,000 H.P. each. Everything that could be done in the way of labour-saving by automatic appliances was to be done. Of all this the moving spirit was the company's engineer, Mr. Ferranti. From first to last the whole conception was his: he saw to the foundations, designed the buildings, specified the materials, prescribed the engines, even planned the chimney stacks. The ELECTRICAL REVIEW of October 26th, 1888, gives a good account of the preliminary operations. What Becton was to be on the north side of the river for gas, that Deptford was to be for electricity on the south side. But what of the cables, the arteries of this vast transmission? Ferranti had secured wayleaves along the lines of railway to Charing Cross, and so, able general that he is, had made secure his lines of communication without being at the mercy of local authorities or Board of Trade orders. Further, he had conceived a new kind of cable—the famous concentric copper tubes, with outer earthed, and insulated within by impregnated paper. Forthwith he found himself embarking on two new enterprises. The firm of Ferranti & Co. grew up in Charterhouse Square to undertake the manufacture of dynamos, transformers, and meters, while the British Insulated Wire Co., at Prescot, arose out of the Ferranti method of high-voltage insulation.

Photo by] *[Lafayette.*

SEBASTIAN Z. DE FERRANTI.

Meantime the Grosvenor Gallery station had reached its limiting capacity of some 33,000 lamps, and the date for changing over to the supply from Deptford was anxiously awaited. On October 1st, 1889, the new station was complete; and all promised well. At the Board of Trade inquiry the previous April, Ferranti had triumphantly faced a two days' cross-examination on his schemes. He was calmly confident of the engineering possibilities, and of the high efficiency of his plans. With equal calmness he superintended the difficult operations of rearranging the circuits in the West End as the supply was changed over from Grosvenor Gallery to Deptford. This change required several months, and was not yet completed when a great disaster befell the enterprise. Owing to a short-circuit in the temporary switchboards at the Grosvenor Gallery a destructive fire broke out on November 21st, 1890, and not until February, 1891, could a fresh start be made. These were stirring times: the success or failure of a pioneer electric lighting system was like the success or failure of an Atlantic cable. All pioneers must at times take their courage in both hands; and unforeseen disasters may interrupt or even wreck the boldest schemes. By a happy

thought a contemporary speaker likened Mr. Ferranti, in his work as pioneer of high-voltage distribution schemes, to Brunel, the pioneer of broad-gauge railways. The comparison is not unjust, for both men had a conspicuous largeness of conception and a practical genius for execution: but while the broad-gauge railway of Brunel has succumbed in its rivalry with the narrow-gauge of to-day, the high-voltage distribution of Ferranti has proved itself of permanent value. The very men who in 1888 shuddered at the suggestion of 10,000 volts now hear with composure of electric transmission at 50,000, 60,000, or even 80,000 volts—and the end is not yet.

It would spin out history too greatly to recount the ups and downs of the London Electric Supply Corporation: of its financial difficulties and their subsequent retrieval. They caused the abandonment of the two half-completed machines of 10,000 H.P.; and led to Mr. Ferranti resigning his post as chief electrician. He had found other centres for his activities at Portsmouth, Havre, and many other places. The ELECTRICAL REVIEW, of November 20th, 1895, under the title of "Deptford Revisited," showed how Ferranti's machines of newer type had been added to those of the original installation. Meantime his own works had outgrown Charterhouse Square, and in 1894 they were removed to Hollinwood, near Manchester.

It was about this time that Mr. Ferranti lectured to the Royal Scottish Society of Arts upon electrical developments of the future. A memorable lecture this was, and one which stated with great clearness the economic questions involved in the cheapening of electric supply. He dwelt with special emphasis on the probability that the essential factor in the problem of cheap electric supply, namely, cheap motive power, would be found in the internal combustion engine.

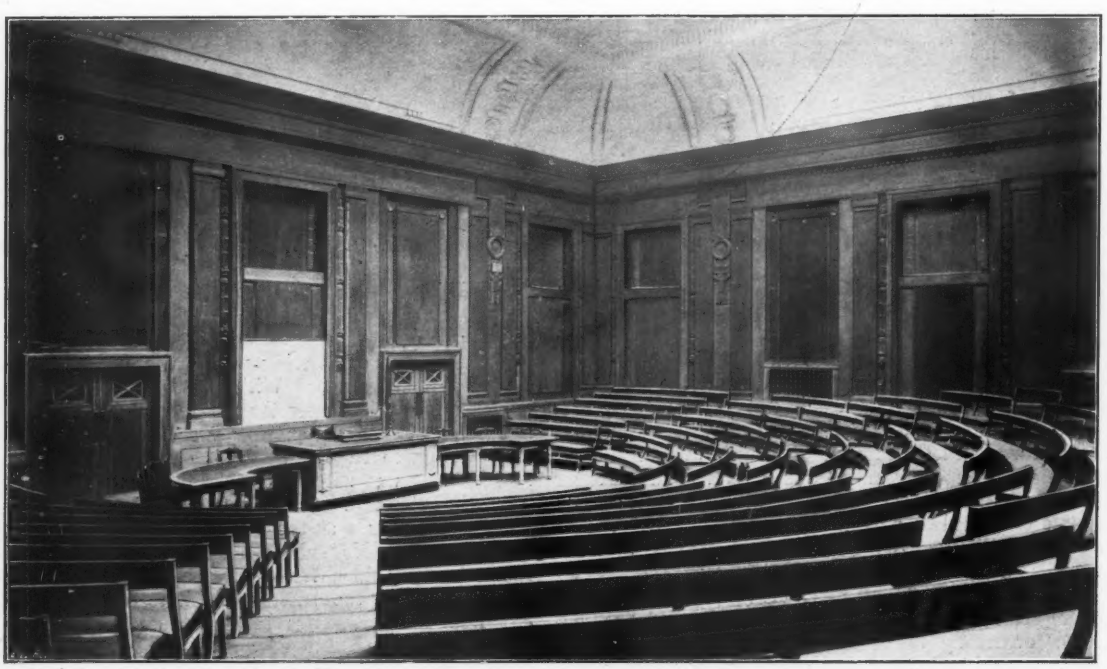
Those who know Mr. Ferranti best will recognise how, through all his work—through his failures as well as through his successes—there has always run this thread of thought—how to shape the project in hand to the economic needs of the future. It is this that has made him incessant in his endeavours to improve whatever came under his hand—to redesign, where a mere commercial agent would have been content with the thing that was; to spend on further inventing the cash earned by some earlier manufacture; to throw himself with the vigour of unabated youth into developments of which he himself scarcely dreamed a quarter of a century before. A genuine human being, who looks straight at you, and says what he thinks, and is fearless in act as in word—that is Sebastian Ziani de Ferranti, pioneer of electric distribution in bulk, and now most deservedly chosen as head, for the present year of office, of the profession which he adorns.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

LAST night the first ordinary general meeting in the new headquarters of the Institution was held. The occasion marks a new era in the history of the Society, which now at last has succeeded in fulfilling the dream, long cherished, of acquiring a home of its own; moreover, the building is one which the members may reasonably regard with satisfaction as being in every respect worthy of the Institution, and capable of meeting all possible demands upon it in the future. For the information of those members who are not able at present to visit the building, we give herewith a number of views of the interior, which we have been enabled to photograph by the courtesy of the Council.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The decision to purchase the building was made in June, 1908, at a special general meeting called for the purpose in the building itself, the purchase price being £50,000. The transaction was completed on June 1st, 1909, and on July

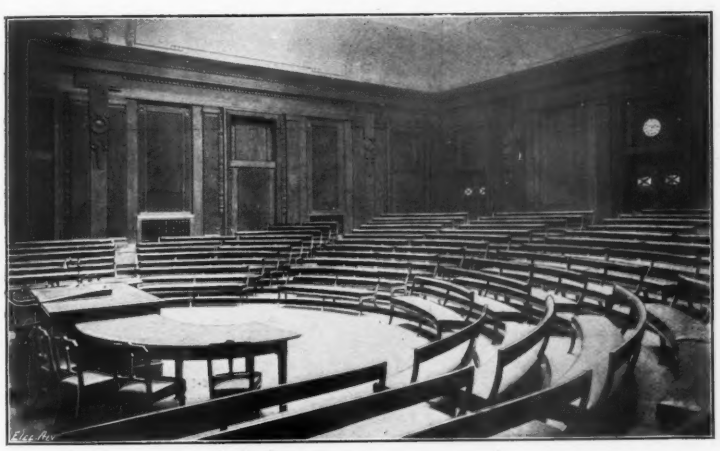


LECTURE THEATRE.

29th the expenditure of a sum of £20,000 was authorised for the enlargement of the entrance hall and rebuilding of the principal structural changes consisted in the entire reconstruction of the entrance hall, which in its original form was very inconveniently arranged, and the rebuilding of the theatre to occupy the whole of the quadrangle; the cost of the alterations was about £17,000, and that of the furniture and equipment £1,800. The contractors for the alterations were Messrs. Prestige & Co.; the furniture in the theatre was supplied by Messrs. Hampton & Son, and that of the rest of the building by Messrs. Shoolbred & Co.

Entrance Hall.

The entrance hall now presents a remarkable contrast to its original appearance; besides being entirely remodelled, it is lined throughout with Pentelikon white marble, with ornamental bronze tablets, modelled by Mr. Pibworth, on the bases of the columns and the friezes. The vestibules and staircases are also lined with white marble, the original central staircase having been replaced by two flights to the right and left of the hall. On either side of the hall is a cloak room, fitted on the latest system, with accommodation for 380 persons' belongings, and on the right is the inquiry office, on the left the entrance to the common room. Facing the main entrance, which is provided with double swing doors, is the entrance to the lecture theatre; the latter occupies a site about 60 ft. square, and is an extremely fine room. It

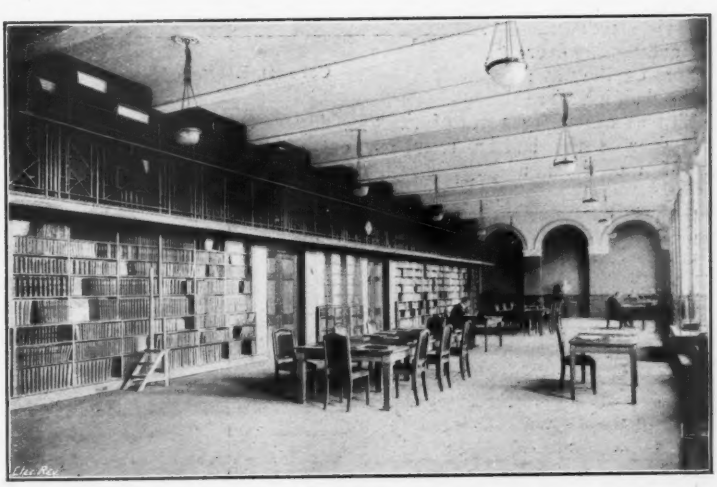


Theatre, Looking Southward.

Vestibule.

theatre, according to plans prepared by the well-known architects, Messrs. H. Percy Adams and Charles Holden. In June, 1910, the work of removal commenced, and on June 23rd the official address of the Institution was transferred to the new headquarters. The whole of the work of altering, redecorating and furnishing the building is now practically complete, and it will be found that, in accordance with the best traditions of electrical engineering, a first-class job has been made of it.

The site occupies an area of about 22,000 sq. ft., and the building, which was erected in 1885, consists of four floors and a basement; the front faces southwards on the Embankment, and the site is bounded by Savoy Street and Savoy Hill on the east and west sides respectively, and a private roadway at the back. The building was originally the Medical Examination Hall of the Royal College of Physicians and the Royal College of Surgeons, who still occupy a large portion of the premises as tenants of the Institution. The arrangement of the rooms is shown on the plans on page 791. The



Library.

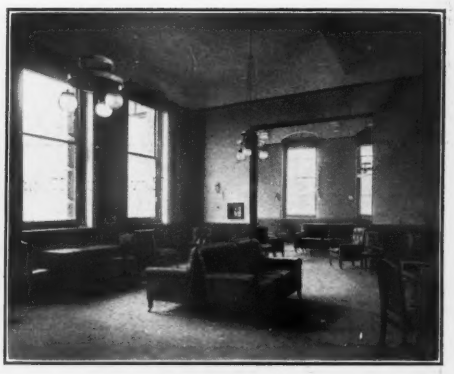
Common Room.

is panelled throughout with the best untreated Cuba mahogany, relieved with carvings by Mr. Frith, and surmounted by curved white friezes, which serve as reflecting and diffusing surfaces for the system of concealed lighting, which will be described later. The ceiling is of glass, and is covered by a glass roof. Round the theatre are inscribed the names of eight of the great electrical pioneers—Faraday and Kelvin on either side on the north wall, and Volta, Ohm, Ampère, Henry, Maxwell and Hopkinson on the other walls. The theatre at present provides sitting accommodation for nearly 420 persons, but space is available for about 50 more if required. It is ventilated by an electric fan in the roof, the fresh air entering through brass grilles round the walls, and passing over radiators on the way; additional air inlets are provided at the upper parts of the panelling. Over the centre door is the lantern room, cut out of the thickness of the wall; a large screen is provided behind the President's table, which is raised and lowered by a concealed wire rope from the lantern room, and roller blinds for the exhibition of wall diagrams are provided round three sides of the theatre.

It is interesting to note that in rebuilding the theatre it was necessary to cut through a steel girder 6 ft. deep, which passed across the quadrangle at a height of about 50 ft.; this was accomplished with the oxy-acetylene blowpipe in two hours, an operation which would have taken several weeks to perform by hand. It is believed that this is the first application of the process to work of this kind in London.

Behind the theatre is a corridor, of which the floor, formerly 3 ft. 6 in. higher, has been lowered to the level of the floor of the theatre; from this corridor doors open at a height of about 5 ft. over the private roadway at the back, and thus, with the aid of tackle for which provision has been made, it will be an easy matter to unload heavy machinery from a lorry and move it across the corridor into the lecture

Secretary's Office.

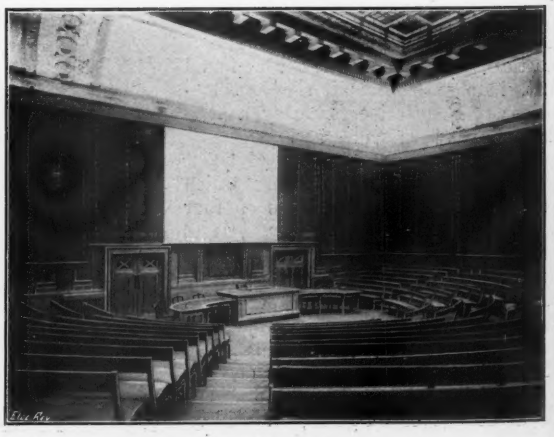


Common Room.

Council Room.

General Office.

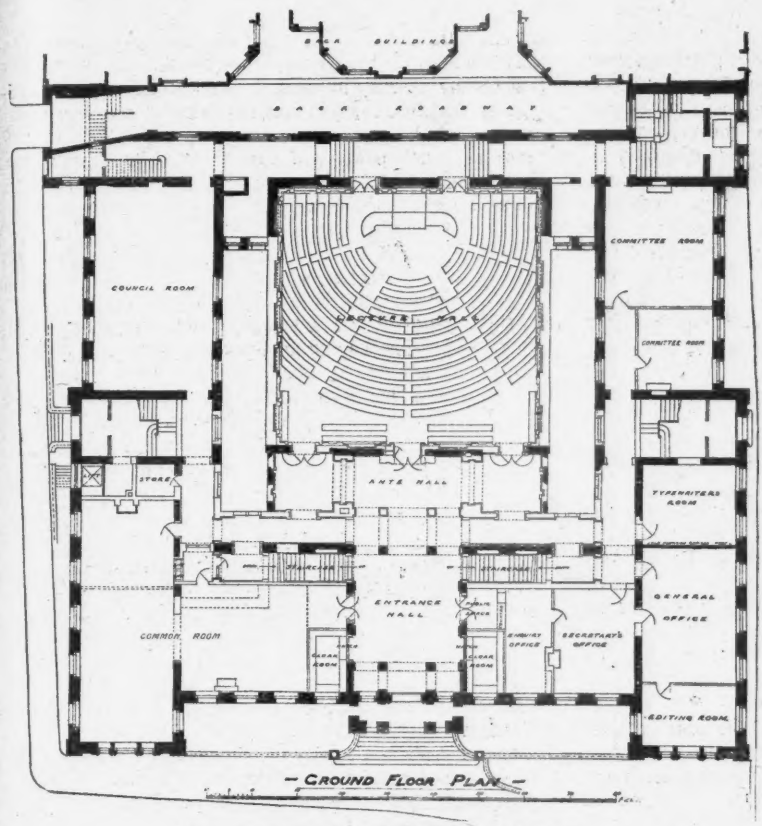
Lavatory.



Theatre by Artificial Light.

theatre. The arrangement also provides a ready escape from the theatre in case of fire.

The common room, which consists of two rooms thrown into one, is spacious and comfortably furnished as a sitting and reading room, in which smoking will be permitted; it will also serve as a refreshment room after the meetings and on other occasions, a Waygood push-button service lift from the basement being provided to facilitate this. The lift ascends also to the mezzanine floor, so as to serve the library. In the basement are the kitchens and a "boiling room" fitted with six electric tea and coffee urns by the General Electric Co., Ltd.



THE INSTITUTION OF ELECTRICAL ENGINEERS.

Behind the common room is the council room, a large and handsome apartment. At the east end, through the inquiry office, is the secretary's room, and beyond it the general office and the editing room; behind these are two committee rooms. The general office and committee rooms, as well as the council room, are directly accessible from the main corridor.

The two staircases meet on the first floor in an antehall, out of which opens the library, an exceedingly fine room, with outlook over the Embankment and the river. The whole of one side of the library is fitted with shelves, and there is a gallery approached by stairs at either end. The wing rooms are at present in the occupation of the Colleges, but when their tenancy ceases these may also be thrown into the library, making a magnificent suite. All the later books since 1890 have been placed on the shelves according to subjects. We may mention that so far as electrical works in all languages are concerned, the library is right up to date, and is probably excelled in this respect by no other collection, except perhaps that of the British Museum, including also all of the earlier books that can be procured. A considerable number of books on allied subjects is also to be found here. Special congratulations are due to the Institution on its possession of this fine room and its admirable equipment.

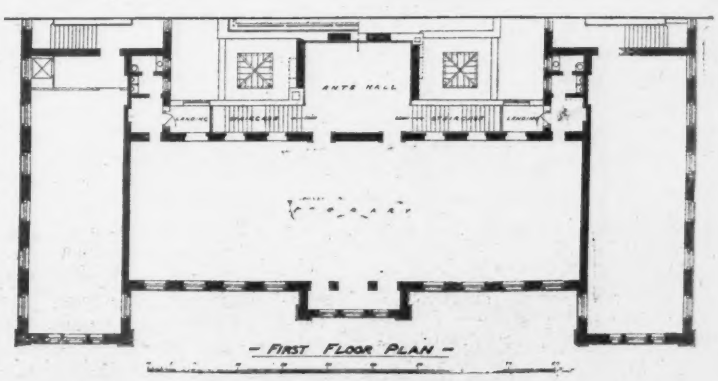
In the basement there is a lavatory, entirely new, with marble floor and white tiled walls, and fitted with every convenience. Other rooms in the basement are allotted to stores, a museum and the accommodation of the caretaker.

The whole of the building, including the part in the occupation of the Colleges, is provided with hot water for heating and other purposes by the Institution, for which purpose there are five boilers in the basement. In some rooms the original water-pipes have been retained for heating purposes; elsewhere radiators have been installed. A private telephone exchange is situated in the general office, with seven extensions (764 Gerrard), and a separate call-office telephone is provided for the use of members. A master clock on the Magneta system is installed in the common room, controlling 14 dials in various parts of the building.

Naturally the electric supply of the Institution is of more than ordinary interest. The consulting engineers for this work were Messrs. Handcock and Dykes, who have spared no pains to render the installation a model of its kind.

The building has for some years been supplied with electricity at 100 volts D.C. from the Savoy Hotel, on the opposite side of Savoy Hill, and this arrangement has not been disturbed. Continuity of supply is assured by a stand-by connection of the Savoy Hotel with the mains of the Charing Cross and City Electric Supply Co., and the charges are based on a flat rate for lighting, and for the boiling apparatus, with a lower rate for power, which includes the driving of the electric fan and lift, and the supply to the table in the theatre.

Messrs. Handcock & Dykes commenced their investigations in December, 1908. They found that the wiring had been carried out by Messrs. Veritys, Ltd., as long ago as 1888, with pure rubber-insulated cables in wood casing, and that it was in excellent condition; in fact, it was possible to retain a large portion of the wiring in use, *i.e.*, in the portions of the building still occupied by the Medical Colleges.



In addition to the old duplicate service mains from the Savoy Hotel, two new mains were laid, in ducts under the street, to a meter house in the area. From this point four pairs of old 19/12 lead-covered jute-insulated mains running to two circuit boards in the basement have been utilised, one feeding the Colleges through a portion of the original board, another

feeding the Institution circuits at the back of the building, one supplying in parallel two new circuit boards which have replaced the old one in the front of the building, for the lighting of the Colleges on the top floor, and the fourth feeding a circuit board for the front portion of the Institution premises. Thus the supply to the Colleges has been completely divided from that to the Institution. A new 19/18 armoured main has been run from the meter house to the boiling room, to supply the six urns, each of which holds three gallons and takes 1 KW., through a six-way switch and fuseboard. In the basement under the corridor behind the theatre, a special terminal board is fixed, connected with a similar board in the theatre, behind the lecture table, giving five ways fed through a power meter and one (for a lantern) from the lighting circuits. It is intended to install a motor-generator in the basement, which can be connected to these terminals so as to supply any desired kind of direct or alternating current for experimental purposes. A telephone connection between the two points is also provided. From the terminal board in the theatre a cable duct is brought under the floor to a convenient position, concealed by a trap, in front of the table; a sink, with gas and water supplies, is also provided, similarly concealed. These arrangements will enable experimental demonstrations of all kinds to be performed with the greatest ease and convenience. The connections for a signal bell and lamp on the table are neatly contrived with flexible wiring through the platform to a plug and socket, so that the table and platform can be removed, if required, without inconvenience.

The lantern room, over the main entrance to the theatre, is provided with three 35-ampere double-throw switches and three fuseboards, connected with a similar set of switches at the side of the door below; two of the switches control the cornice lighting and one the lay-light lamps, and the connections are such that each of the three sections can be put on or off at will from either position. In the lantern room there is also a 50-ampere D.P. switch and fuse for the lantern, with ammeter and rheostat, and fireproof flex depending from above to the lantern.

The theatre itself is lighted in two ways. Round the base of the curved frieze, which is well seen in our illustrations, there are a number of hidden battens, each fitted with 25-watt Osram lamps in a horizontal position, there being 220 lamps in all; the battens are provided with hinges and flexible connections, so that they can readily be brought into a convenient position for attention. The battens are connected in pairs to alternate plug points, of which there are 10, each plug circuit having a separate fuse in the lantern room, and glass mirrors are arranged at the bottom of the cornice to throw the light upwards upon the frieze. Each of the main switches abovementioned controls half the cornice lighting, in equal alternate groups. The lay-light is provided by four Westinghouse Silica lamps, taking 4 amperes each and giving 1,200 C.P., which are controlled by the third main switch. The result is highly effective, there being ample light in all parts of the theatre, without any glare whatever, while the red and yellow components of the incandescent lighting neutralise the greenish tint of the mercury arcs. The system of lighting adopted for the theatre is of especial interest as a typical application of modern scientific methods to the solution of a difficult problem of illumination; and it is to be hoped that the standard thus set up will lead to the abolition of some of the barbarous examples of "lighting" so often met with. The electric fan in the roof, of 1 H.P., was supplied by Messrs. Bergtheil & Young, and is regulated with a rheostat in the back corridor.

The wiring was carried out by Messrs. Drake & Gorham, Ltd., mainly on the Kalkos system, the contractors having the option of using this or screwed barrel as they might prefer. In the basement the wiring is on the surface, except in the lavatory; everywhere else it is concealed, and it is entirely water-proof and on the draw-in system, the whole of the wires being drawn in after the plastering was completed. The tubing is earthed at several points. C.M.A. V.R. wires have been used in three-ampere (10-light) circuits, consisting of 3/20 from the distribution boards, and 3/22 for individual lamps. Tucker switches are used, in Kalkos adjustable boxes, which have enabled the switch plates, &c., to be fixed perfectly flat on the wall surface, making a very neat finish. Osram lamps have been installed.

The fittings are Messrs. Osler's glass fittings, and the Birmingham Guild's metal fittings; some of the former may be seen in our views of the hall and library, and the latter in the Council room and common room. In the common room there are also three switch and fuse-boxes for connecting apparatus for experiment or demonstration.

Minor services include telephones from the service lift landings to the kitchens, and bells connecting the secretary's room with six points and the committee rooms with the general office; all these are wired with Stannos wire, using the outer as a return. The "conditions of contract" were those recommended by the Institution, suitably modified.

From the foregoing particulars and the accompanying views it will be seen that the home which the Institution has acquired is excellently adapted for its purpose, and the members have every reason to be proud of it. The Council are to be heartily congratulated on the admirable headquarters which they have provided for the Institution, in the centre of the metropolis. Our thanks are due to the secretary, Mr. P. F. Rowell; to the architect, Mr. H. Percy Adams; and to the consulting engineers, Messrs. Handcock & Dykes, for their kind assistance in the preparation of this article.

CONTRACTS OPEN.

(*Continued from page* 785.)

Walthamstow. — November 25th. One 1,000-KW. mixed-pressure turbine, with tandem generators of 500 KW. each, and surface condenser and pipework, for the U.D.C. See "Official Notices" November 4th.

Warrington.—November 15th. Motors and transformers for a year, for the Corporation Electricity Department. See "Official Notices" October 21st.

Watford.—The electrical engineer has been instructed to obtain quotations for 12 months' supply of meters.

York.—November 24th. Telegraph apparatus and telegraph wire and line stores, for a year from January 1st, for the North-Eastern Railway Co.; C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Atherton (Lancs.).—The Electricity Committee has accepted the following tenders:—

Callender's Cable and Construction Co., Ltd.—1,100 yards of concentric cable.

British Electric Transformer Co., Ltd.—Two single-phase oil-cooled transformers.

Australia.—The *Australian Mining Standard* states that the Sydney Council has accepted the following:—

Lightning arresters.—Australian General Electric Co., £476.

Two weighbridges for power house.—Gibson, Battle & Co., £357.

The same exchange states that the P.M.G.'s Department, New South Wales, has ordered the following:—

Western Electric Co. (Australia), Ltd.—Common-battery switchboard, with associated plant, at North Sydney, £7,546; 10 switchboards, 1 and 3 lines (cordless), at £8 11s. 6d. each; 10 switchboards, 2 and 6 lines (ditto), at £11 14s. 9d. each; 5 switchboards, 3 and 10 lines, at £19 4s. 6d. each; 5 switchboards, 6 and 20 lines, at £28 15s. each; 50 telephone wall-sets for party lines, at £2 11s. 6d. each; 10 telephone table-sets, for party lines, at £2 3s. 7d. each; 1,560 power protectors for wall and table sets for above equipment, at 2s. each.

British Insulated and Helsby Cables, Ltd.—1,400 wall telephone sets (type 411), at £1 18s. 6d. each; 100 table telephone sets (type 460), at £1 13s. each.

Chester-le-Street.—The R.D.C. has accepted the tender of Messrs. Cox-Walkers, Ltd., of Darlington, for an electric fan and overhead wires at the Sanatorium, at £230.

Chingford.—The Metropolitan Water Board has decided to enter into a contract with the Pump and Power Co., Ltd., for the installation of five "Humphrey" gas pumps at Chingford reservoir, at a cost of £19,388. Two electrically driven compressors are to be used for starting purposes.

Dewsbury. — The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for 2,640 yards of cable.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. Speakman & Co., of Queenborough, for washed pearl slack for the electricity works, at 14s. per ton.

Gloucester.—For the Corporation electricity works, two "Bennis" high-duty, smokeless and gritless coking stokers and self-cleaning compressed-air furnaces have been ordered from Messrs. Ed. Bennis & Co., Ltd.

Hendon.—Messrs. Francis Reade & Co., of Finchley, have received the order for the erection of a gas engine and dynamo and lighting instsllation for the London Aerodrome Co., Ltd., at their aerodrome at Hendon.

Llandaff.—The D.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of meters and meter-boards.

London.—L.C.C.—The Education Committee reports that the London Electrical Engineering Co., who submitted the lowest tender for the electric lighting of the Sherington Road School (Greenwich), £253, have withdrawn their offer, owing to an omission of £25 for contingencies. The tender of Messrs. E. Newbald & Co., at £256, has therefore been accepted. It is advised by the Committee that the Council do not consider any further tenders from the London Electrical Engineering Co., for work at its schools for one year.

The Metropolitan Asylums Board has accepted the quotation of W. J. Fryer & Co. for alterations in the wiring and supplying low-voltage lamps to the children's home at Tooting Bec Asylum, at £35.

Sheffield.—At the last meeting of the City Council the tenders of the Corporation Electricity Supply Department were accepted, at £115 17s. 6d., for certain work at the Worthing Road depôt and at the Park baths. After adjusting certain items, it has been found that the tender of Messrs. T. A. Ashton, Ltd., is 2s. 6d. less, and the Health Committee has decided to rescind its first resolution and give Messrs. Ashton the work.

Stafford.—The T.C. has accepted the tender of Messrs. J. Wooldridge & Son for 2,000 tons of engine slack, for the electricity works.

Stoke-on-Trent.—Two "Bennis" stokers and self-cleaning compressed-air furnaces have been ordered from Messrs. Ed. Bennis & Co., Ltd., for Hanley electricity works.

Walsall.—The T.C. has accepted the following tenders:—

Edward Bennis & Co., Ltd.—Two coal elevators, together with driving shaft. £175.

British Westinghouse Co., Ltd.—Transformer, £74; switchgear and meter, £57 10s.

Union Electric Co., Ltd.—Two E.H.T. switches, £12 12s.

Electric Power Storage Co., Ltd. Removal, overhauling and cleaning St. George's Hall sub-station battery and re-erecting same at Darwell Street, £79, plus new plates.

Watford.—The U.D.C. has accepted the tender of the British Westinghouse Co. for 12 months' supply of transformers.

West Ham.—The T.C. received 13 tenders for the supply of 12 new tramcars, and accepted the following:—

Hurst, Nelson & Co., Ltd.—Car bodies, £371 each; trucks, £117 10s. per pair.

Dick, Kerr & Co., Ltd.—Electrical equipment, £327 10s. per car.

FORTHCOMING EVENTS.

Physical Society.—Friday, November 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Supposed Propagation of Equatorial Magnetic Disturbances with Velocities of the Order of 100 Miles per Second," by Mr. C. Chree; and "Exhibition of a Brightness Photometer," by Mr. J. S. Dow.

Glasgow Technical College Scientific Society.—Saturday, November 12th. At 7.30 p.m. Paper on "Modern Lathes and Methods," by Mr. R. Lang.

Manchester Association of Engineers.—Saturday, November 12th. Paper on "Humphrey Pumps and Compressors," by Mr. H. A. Humphrey.

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 14th. At 8 p.m. Paper on "Foundry Plant, Machinery, and Working," by Mr. E. Timothy.

Junior Institution of Engineers.—Monday, November 14th. At 7 p.m. At Caxton Hall, Westminster. Reception, dance and whist drive.

Tuesday, November 15th. At 7.30 p.m. At the Royal United Service Institution, Whitehall. Presidential address on "The Influence of Pure Science in Engineering," by Sir J. J. Thomson.

Institution of Civil Engineers.—Tuesday, November 15th. At 8 p.m. Further discussion on Mr. G. W. Humphreys' paper on "The L.C.C. Holborn to Strand Improvement and Tramway Subway."

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 15th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Recent Electric Locomotive Practice and the H.T. Direct-Current Railway System," by Mr. A. Monkhouse.

Royal Society of Arts.—Wednesday, November 16th. At 8 p.m. First meeting of the session. Presidential address by Sir J. Cameron Lang.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, November 16th. At 7.15 p.m. At the University, Leeds. First meeting of the session. Inaugural address by Mr. T. Harding Churton.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, November 18th. Meeting at 8 p.m. At the Technical College, Glasgow.

Institution of Mechanical Engineers.—Friday, November 18th. At 8 p.m. At the Institution House, Storey's Gate, S.W. Paper on "The Development of Road Locomotion in Recent Years," by Mr. L. A. Legros.

Electro-Harmonic Society.—Monday, November 21st. Ladies' Night.

British Association, 1913.—It is proposed that the Association shall hold its 1913 meeting at Birmingham.

NOTES.

Gill v. J. Stone & Co., Ltd.—Yesterday morning judgment was given in favour of the plaintiff in this case, of which a report is commenced on another page of this issue.

The Olympia Motor-Car Show.—Although there is only one exhibitor of electrical motor vehicles, the Electrical Vehicle Co., at the Motor-Car Show at present being held at Olympia, W., there is ample evidence that the spread of the automobile movement has given rise to an enormous demand for electrical devices in connection with the ignition of the charge in petrol motors, while as regards the illumination of all classes of automobiles, electricity has taken a very prominent, if not the leading place. In this connection reference may be made to the several ingenious dynamos that have been introduced for car lighting purposes, designed to give a steady output notwithstanding the variations in the speed at which they are driven.

Municipal "Hire-Purchase" Litigation.—The Gillingham District Council on Tuesday sued a tailor and outfitter, Mr. Thomas Nye, of Ordnance Place, Chatham, to recover £10 0s. 2d., balance for unpaid instalments in respect of electric wiring and fitments obtained from the Council under a "hire-purchase" agreement for three years. It seems that the defendant entered into an agreement with the Council for them to wire and fit up his premises, then at 77, Canterbury Street, Gillingham, and electric lamps and arc lamps were also supplied. This was under a three years' agreement. Defendant gave the Council notice to terminate the agreement, and they accepted his notice. He then paid up for all current supplied and the use of fitments, &c., up to date, but the Council held him liable for the remaining instalments unpaid under the agreement, and hence this action before his Hon. Judge Shortt. The case was argued by the Town Clerk of Gillingham for plaintiffs, and Mr. L. A. Goldie for the defence. The Council admitted having taken possession of the apparatus used by the defendant under a clause of the agreement, and also admitted taking the outside arc lamp away, but not the wiring, as the landlord would not allow them to do so. They also admitted that succeeding tenants had had the use of the wiring, in the supply of current by the Council, but the Council claimed that defendant was liable for all remaining instalments under the agreement. The defence was that defendant had given proper notice, which had been accepted by the Council, and he was no longer liable for anything further. His Honour was of this opinion in ordering a nonsuit, with costs, against the Council. He put forward an ordinary case of hire-purchase (say a sewing machine), and said if the hirer had got into arrear in the instalments and the owners took possession of that machine, surely they could not bring an action for all the remaining instalments.

Copper.—Stocks, as shown by Messrs. Merton's circular, are now reducing perceptibly, having fallen to 88,422 tons, a reduction of 5,539 tons during October. Part of this is due to smaller quantities afloat from Australia, 1,600 tons being made up this way; the rest has been transferred from British ports. French visible supplies are slightly up (93 tons), the total being 6,592 tons. Supplies from North America to Europe are up to the average for the past 12 months. From Spain and Portugal to England and France the same obtains, the quantity to other countries being 1,300 tons above the average. The shipments from Chile and Australia are both high. Deliveries are above the average, though not so high as for September. American visible supplies dropped 8,968 tons during September, a large amount on a total of 75,393 tons, which is thus reduced to 66,425 tons, with every prospect of another heavy subtraction during October.

The National Physical Laboratory.—By the generosity of Sir Julius Wernher, who recently placed a sum of £10,000 at the disposal of the Committee for the purpose, a much-needed extension of the Department of Metallurgy has now been commenced. The Department has, up to the present, been accommodated in a number of scattered rooms in Bushy House, which, in consequence of the increase and importance of the work, have become quite inadequate. Plans have been prepared in consultation with Dr. Rosenhain, the Superintendent of the Department, and the contract has been let to Messrs. Dick, Kerr & Co., who have already made good progress with the foundations.

Institution Notes.—ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At a meeting of the recently-formed West of Scotland branch of the Association held in Glasgow, the Hon. Secretary (Mr. D. Martin), reported that the membership of the branch now numbered 76. The President (Mr. A. Anderson) in the course of his inaugural address, said that the members might be divided broadly into four classes, viz., the colliery manager, the consulting engineer, the manufacturer and the colliery engineer. The colliery manager must be an all-round man. With the rapid growth of the electrical industry they must recognise the difficulty of the colliery manager in keeping himself in touch with the great amount of detail inseparable from an installation of electricity of any importance. That difficulty, however, was being overcome in some cases by colliery owners having on their staff men with the necessary training, and in others by their engaging men who made consulting work their special study. By adopting a fair standard of comparison the consulting engineer was in a good position to checkmate the class of manufacturer whose motto was, "Low price and get the order at all costs." His intervention would probably mean that a certain class of plant, unfortunately well-known to most of them, would become a thing of the past. It was to the

manufacturer that they must look for the working out and perfecting of designs of the plant and apparatus in which he specialised, to best suit the varied requirements of the mine. The day was fast approaching when there would be no distinct line of demarcation between what were called the mining-electrical and the mining-mechanical engineers. He could not see how a state of things could long exist where two classes of men were held responsible for the same machines. It was very necessary that their electrical engineers should be competent to look after themselves in the mine, and not be under the necessity of always being accompanied by a roadsman or some other experienced person.

Physical Society of London.—At a meeting held on October 28th, 1910, a paper entitled "A New Method for Producing High-Tension Discharges" was read by Prof. Ernest Wilson and Mr. W. H. Wilson. According to this method, energy is taken from an alternating or continuous-current source and stored in a magnetic field by an inductance; it is then permitted to surge into a condenser which forms with the inductance a low-frequency oscillating circuit. When the energy is stored in the condenser, the latter is mechanically bridged across the primary winding of a spark-coil, with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding of the spark-coil to the work circuit in a well-known manner. The method therefore involves the use of an inductance, a condenser, a spark-coil and a special contact-making device. The connections were shown on page 518 of our issue of September 23rd. Prof. Wilson, in reply to questions, stated that the adjustment of the commutator was performed experimentally. Using an air-coil for primary, enormous frequencies could be obtained in the secondary. The efficiency of the instrument was high compared with that of ordinary coils. The electromotive force induced in the secondary was oscillatory, but in the experiment shown, the X-ray bulb acted as a rectifier. A paper on "The Behaviour of Steel under Combined Static Stress and Shock" was read by Mr. F. Rogers.

Royal Society.—Sir Archibald Geikie, K.C.B., D.C.L., &c., is recommended for the presidency for the coming year.

Royal Institution.—The eighty-fifth Christmas Course of Juvenile Lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. Silvanus P. Thompson, D.Sc., F.R.S., M.R.I., his subject being "Sound, Musical and Non-musical: A Course of Experimental Acoustics." The lectures will be delivered on the following days, at 3 o'clock: December 29th, December 31st, 1910, January 3rd, 5th, 7th and 10th, 1911.

Royal Society of Arts.—The programme of arrangements for November and December includes the following:—Opening address by Sir J. C. Lamb, November 16th; Cantor Lectures on "Industrial Pyrometry," by Mr. C. R. Darling, November 21st, 28th, December 5th and 12th; "Methods of Detecting Fire-Damp in Mines," by Sir H. H. Cunynghame, November 23rd; "Progress and Prospects of Mining in Western Australia," by Mr. A. Montgomery, November 29th; Mr. C. P. Ogilvie, on "Argentina from a British Point of View," November 30th; Dr. Vaughan Cornish, on "The Panama Canal in 1910," December 7th.

Railway Signal and Telegraph Engineering Institute.—The first annual general meeting will be held at the St. Marylebone Church Institute, 59 and 60, Paddington Street, W., on Tuesday, November 29th next, at which the secretary will present his report and balance-sheet, also report on the special general meeting held on September 21st. The business of election of officers for the coming year will also be gone into. We understand that some papers and visits of great interest are being arranged for the coming season.

Association of Teachers in Technical Institutions.—The sixth annual meeting of the Association was held on Saturday last, under the presidency of Mr. J. Wilson (Battersea Polytechnic). The annual report of the Council showed that there had been considerable growth in the strength of the Association during the last year, together with expansion in its work and influence. Pleasure was expressed at the fact that the Board of Education had recently announced its intention to issue, at an early date, regulations making provision for a number of reforms repeatedly urged by this Association, including such matters as the increased co-ordination of continuation schools and the provision of organised day continuation schools. Mr. Barker North, A.R.C.Sc., of Bradford Technical College, was elected president, and the hon. secretary, Mr. P. Abbott, B.A., of the Polytechnic, Regent Street, W., was re-elected.

Institution of Civil Engineers.—At the ordinary meeting on Tuesday last a paper was read on "The London County Council Holborn to Strand Improvement, and Tramway Subway," by G. W. Humphreys, M.Inst.C.E.

Institution of Electrical Engineers (Dublin Section).—The inaugural meeting of the session was held yesterday, when the new Chairman, Mr. W. Tatlow, M.A., B.A.I., delivered his inaugural address on "Practical Electrical Measurements."

Institution of Electrical Engineers.—The annual dinner and reunion is to be held at the Hotel Cecil, Strand, on Tuesday, December 6th, Mr. S. Z. de Ferranti presiding.

The New York Terminal of the Pennsylvania Railway.—On September 8th that portion of the gigantic terminal of the Pennsylvania Railway devoted to the Long Island Railway, was opened to traffic. The station proper covers 8 acres, and its cost is estimated at £2,400,000, and the cost of the entire work from Harrison to Long Island and across New York is, according to the New York *Electrical World*, £22,200,000. The station building is 774 ft. long and 433 ft. wide, with an average height above the street of 69 ft. There are 11 platforms in the station, while within the station area there is a total of 16 miles of track.

The power station supplying the energy for the operation of the tunnel line and the Long Island Railway is situated at Long Island City, and can accommodate six units of 5,500 kw. and two of 3,000 kw. for lighting the tunnels, while the ultimate capacity of this station when extended will be 105,000 kw.

The plant for lighting, heating, and ventilating the terminal is located in a separate building at the station. The exhaust steam from the auxiliary plant required for this purpose is used for heating the buildings, while live steam is used for carriage heating. The distance of this station from an economical supply of condensing water necessitated the use of non-condensing plant, and confirmed the utility of exhaust steam as a means of supplying the needed heat with the greatest economy. Two 11,000-volt cables passing through the tunnel from the main power station are used through the summer and in the event of breakdown.

The general lighting of the station is carried out by Nernst lamps, with occasional incandescent lighting, the total candle-power being 512,000.

In the boiler room of this auxiliary power station are five 525-h.p. Babcock & Wilcox boilers, working at 200 lb. per sq. in., fitted with automatic stokers and using forced draught. Fuel is handled and stored by belt conveyors and skip hoists, capable of handling 100 tons per hour, the bunker capacity being 1,000 tons. The whole conveying and distributing plant can be operated from one point by a single man.

In the engine room are two 1,000-kw. 60-cycle three-phase 240-volt turbo-alternators, which can be used for lighting the terminal at any time when exhaust steam is required for heating purposes. The generators are excited by two motor-driven 40-kw. generators, and there is a 60-cell 400 ampere-hour battery for relay excitation.

The switchboard comprises 17 panels; a section is used for controlling the alternators, transformers, exciters, &c., while a second section controls 24 lighting feeders, and a third is used for 12 motor-feeders. The 1,000-kw. alternators connect direct with the lighting bus-bars, and the 11,000-volt service from Long Island is transformed down to 240 volts through one set of three 500-k.v.a. air-blast transformers, and is coupled to the lighting bus-bars. Part is also transformed down to 440 volts for motor service.

The air-compressing plant located in the engine room is used for operating the signalling and interlocking apparatus, &c. There are also two ammonia compressors for cooling the drinking water of the entire station.

To dispose of kitchen refuse, &c., an incinerating plant is installed in the basement, and is capable of burning 16 tons of refuse per day.

One-half of the main floor of the service power station contains three 2,000-kw. rotaries, nine 250-k.v.a. transformers and two switchboards. These are used for the outgoing third-rail feeders and for signalling current.

In all there are 21 ventilating fans, having an exhausting capacity of 13,980,000 cb. ft. of air per hour. Each fan is belted to its own motor, the total aggregating 84½ h.p.

Appointments Vacant.—Senior clerk for the Walthamstow U.D.C. Electricity Department (£120); assistant technical chemist for the Electrical Power Storage Co., Ltd. See our advertisement pages in this issue.

Conference on Municipal Wiring.—A Conference took place in London yesterday (Thursday) morning between electrical contractors and municipal electrical engineers which, it is hoped, may lead to a settlement of the contest over the proposed Bill to facilitate wiring by municipal authorities. The meeting stands adjourned.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. A. J. Abraham has been appointed to the post of engineer and manager of the Aberdare U.D.C.'s electricity and destructor works.

Mr. P. J. Pringle, M.I.E.E., M.I.M.E., who has been borough electrical engineer and tramway manager at Burton-on-Trent for some years is resigning those offices from November 16th in order to go to Australia, where he has accepted an appointment. The Burton Gas and Electricity Committee and the General Purposes Committee have jointly recommended the Corporation to appoint Mr. Thomas Hall, who has been engaged under Mr. Pringle, and has spent nearly 20 years in the Corporation's service, to take charge of the electricity works at £200 per annum, and Mr. A. B. Slater, who was chief clerk of the tramways from the date of their opening, to be chief of the tramways department (six months' trial) at £150 per annum. Mr. Pringle will carry with him to Australia the sincere good wishes of the Electrical Review and a host of other friends for a full measure of success and happiness in his new sphere.

Mr. W. C. Bowler, senior switchboard attendant at Colchester Electricity Works, and Mr. H. E. Munday, junior shift engineer at Hereford Electricity Works, have been appointed shift engineers at the electricity works of the Canterbury Corporation.

The Hackney B.C. Electricity Committee recommends that the salary of MR. E. T. WHEELER, acting collector of electricity accounts, be advanced from £150 to £180 per annum.

MR. A. F. MALYON GATRILL has been appointed chief engineer of the Frinton-on-Sea and District Electric Light and Power Co., Ltd.

The Stoke-on-Trent T.C. has settled the question of compensation for abolition of office of MR. ASHTON BREMNER, electrician to the Burslem T.C., and MR. P. J. S. TIDDEMAN, late electrical engineer to the Stoke T.C., owing to the Federation of Pottery towns. Mr. Ashton is to receive £74 16s. 8d., and Mr. Tiddeman £78 10s.

The Turton U.D.C. has appointed MR. R. B. LEACH, of Manchester, as electrical engineer.

MR. TURNBULL, works superintendent at the York electricity works, having resigned, the Electric Committee of the T.C. has made the following appointments: MR. NICHOLS, mains superintendent, to be chief assistant in the electricity and tramways department; MR. HOLMES, charge engineer, to be works superintendent. MR. E. J. BROOK, of London, has been appointed meter clerk.

The *Australian World* states that MR. H. EDMISTON, who was formerly electrical engineer to the Perth City Council, has been engaged to draft a scheme for the electric lighting of Broome, Western Australia.

General.—*Indian Engineering* states that MR. KENYON, Director of Telegraphs, will retire from the service on the expiry of his leave.

The Royal Society's medals have this year been awarded as follows:—The Rumford Medal to Prof. Heinrich Rubens for his researches on radiation, especially of long wave-length; a Royal Medal to Prof. John Joly, F.R.S., for his researches in physics and geology. The Hughes Medal to Prof. John A. Fleming, F.R.S., for his researches in electricity and electrical measurements.

Obituary.—SIR J. CLIFTON ROBINSON.—Sir J. Clifton Robinson, of tramway fame, has passed away. During the last 50 years out of a busy life of 62 years, his heart and his soul had been in tramways—tramway laying, tramway management, tramway promotion and financing; and as fate and almost fittingness would have it, the seizure which was to end fatally took him just as he had become seated in a New York tramcar, with Lady Robinson, on Sunday evening last. It is impossible for us who have been more or less closely associated with tramway electrification problems in the British Isles during the last 15 or 16 years to forget how largely Sir Clifton Robinson has figured in them. Most people know by this time of his connection—as a boy—with Train at Birkenhead in 1860, and the pride that he took in that connection, and of his other early tramway service and experience in these islands and in America, but it is in London, Bristol, Middlesbrough, and Dublin, from 1904 and 1905 onwards, that we as electrical tramway advocates shall chiefly remember him. That he was a man who had, as we say, "got on," and that no one knew it better than himself, may be said without anything approaching unkindness, and must be said in order to represent him with fairness. We remember how, many years ago, he had to encounter the hostile forces of prejudice when he proposed the adoption of the overhead trolley system. Conversations with him at that period are still fresh in our memory, and we recall the determination with which that hostility was met and that prejudice exposed. He had a method of getting his own way with municipalities, though the London United Tramway shareholders know only too well that he did not always get his own terms; he had a persistency with Parliamentary Committees which other men have desired; he recognised the power of the lay Press, and the lay Press was ever ready to make use of him as a subject upon whom, and whose views, the popular reader loved to dwell. But as it is given to few of us, whether we have "got on" or not, to please everybody, so in Clifton Robinson's case, the man whose undertakings brought him into touch with statesmen and others of eminence at one end, and navvies, car-drivers, and so forth at the other, he was variously regarded. He could be genial or imperious by turns: he was one of those who made friends in some circles, but secured only fear rather than respect in others. He was knighted in 1905. Of Sir Clifton's connection with the London United Tramways, and his interest in and connection with underground electric railway schemes in later years it is not necessary to add anything, as these are well known facts. He had begun life with Train as a boy, collecting fares at the age of 12 on a Birkenhead car; later he was with him in other capacities, including those of driver and conductor, and, seizing the opportunities as they arose, he changed from city to city, increasing his tramway knowledge until now at his death the newspapers label him the "Tramway Magnate" and the "Tramway King." Not many months ago he relinquished his important tramway office in West London, and went abroad to the Philippines, and later to Canada, in connection with financial interests in development properties. It was while returning from such an expedition that his end came. His life is one more illustration of the truth that men can "get on" if they possess grit, will, energy and persistency, provided the opportunity turns up—or they turn it up—and they grasp it.

M. PIERRE PICARD.—We regret to read in the *Times* of the death of M. Pierre Picard, the inventor of a number of improvements in telegraphic transmission, especially in submarine cabling. According to our contemporary's Paris correspondent, M. Picard passed away at Massy on Monday. He held the position of Inspector of the Paris Telegraphs, gave the State the benefit of his inventions, and has died poor. He received the Cross of the Legion of Honour in 1903, and in the same year was awarded the first Hughes prize by the Academie des Sciences.

MR. HUGH BRODIE.—We regret to learn of the death of Mr. Hugh Brodie, the chief electrician at the Nigel G.M. Co., Ltd., Nigel, who succumbed to a severe attack of double pneumonia on July 19th, 1910. Mr. Brodie was a Foundation Associate Member of the South African Institute of Electrical Engineers.

MR. HOLT GREEN.—The *Review of the River Plate* records the death, which occurred on October 6th at Costa Rica, of Mr. Holt Green. "Mr. Green was well known in electrical circles in Buenos Ayres, having been connected with the old Edison station which was afterwards acquired by the Primitiva Gas Co. He left this company several years ago to take up the post of manager of the Costa Rica Light and Power Co., in which post death has claimed him."

NEW COMPANIES REGISTERED.

Mattagami River Falls Sydicate, Ltd. (112,371).—This company was registered on October 25th, with a capital of £1,000 in £1 shares, to carry on the business of an electric light, heat, water and electric power company in all its branches. The subscribers (with one share each) are:—H. S. Goddard, 30, Osborne Road, Stroud Green, N., clerk; W. F. Aldous, 84, Hollydale Road, Peckham, S.E., clerk; F. Chamberlain, 140, Felbrigge Road, Goodmayes, clerk; L. Bird, 35, Talfourd Road, Camberwell, S.E., clerk; C. L. King, The Woodlands, Ashtead, Surrey, solicitor; A. Blake, Sea Cot, Glen Road, Leigh-on-Sea, clerk; F. E. Nubusch, 448, Romford Road, Forest Gate, E., clerk. Minimum cash subscription, £7. Registered without special articles of association. Registered by Spyer & Sons, 65, London Wall, E.C.

S. Bottone & Son, Ltd. (112,436).—This company was registered on October 28th, with a capital of £2,000 in £1 shares, to take over the business of an electrical and mechanical engineer and manufacturer carried on by A. E. R. Bottone, at Wallington, as S. Bottone & Son. The subscribers (with one share each) are:—A. E. R. Bottone, 93, Manor Road, Wallington, Surrey, electrical engineer; J. Husbands, St. Winifreds, Sutton, Surrey, manufacturer. Private company. The number of directors is not to be less than two or more than three; the first are A. E. R. Bottone and J. Husbands; qualification, £100. Registered office, 93, Manor Road, Wallington, Surrey.

Lichtenfeld Burglar Alarm Co., Ltd. (112,522).—This company was registered on November 3rd, with a capital of £3,000 in £1 shares, to carry on the business of mechanical and electrical engineers, founders, manufacturers of burglar and fire indicators, engines, electrical and agricultural instruments, &c., and to adopt an agreement with S. Lichtenfeld. The subscribers are:—S. Lichtenfeld, 300, Regent Street, W., merchant, 100 shares; A. Catta, 28, King Street, Covent Garden, W.C., actuary and secretary, 50 shares; T. R. Edmonds, 300, Regent Street, W., lace merchant, 50 shares; J. H. R. Bright, 104, Great Portland Street, W., mantle manufacturer, 100 shares; T. D. Wadefield, 289, Regent Street, W., surveyor, 30 shares; A. Mischini, Roselinda, Woodstock Road, Golder's Green, N.W., gentleman, 200 shares; P. Dell'Oro, 48, Great Portland Street, W., gentleman, 100 shares. Minimum cash subscription, £1,000; the number of directors is not to be less than two or more than four; S. Siegmund is a life director, subject to holding 100 shares. Registered office, 53, New Broad Street, E.C.

British Lighting Development Co., Ltd. (112,535).—This company was registered on November 4th, with a capital of £1,250 in 1,200 ordinary shares of £1 each, and 1,000 deferred shares of 1s. each, to carry on the business of manufacturers of, and dealers in, gas, electric or other fittings and appliances, motor-cars, carriages and aeroplanes, garage keepers, &c., to acquire the business carried on by the British Lighting Development Co., and to adopt an agreement with J. O. Zdanowich. The subscribers (with one share each) are:—J. O. Zdanowich, 7, Wellesley House, Knaresborough Place, South Kensington, S.W., research chemist and engineer; L. H. Newton, 31, Lombard Street, E.C., chartered accountant. Private company. The first directors are J. O. Zdanowich, G. F. Cobbold and H. H. Dains; qualification, 100 ordinary shares. Registered office, 19, Ingate Place, Queen' Road, Battersea.

CITY NOTES.

Eastern Extension, Australasian and China Telegraph Co., Ltd.

THE seventy-fourth half-yearly general meeting of this company was held on Tuesday at Electra House, Finsbury Pavement, E.C., Sir J. Wolfe Barry, K.C.B., in the chair.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 754), said he thought the shareholders would agree that the accounts for the half-year were not unsatisfactory. The gross receipts had amounted, in round figures, to £345,000, against £291,000 in the corresponding six months, or an increase of £54,000. That substantial amount was derived from increased traffic all over the company's system, but the greater part of it was undoubtedly attributable to the remarkable development that had taken place in the rubber industry during the past year or two. The working expenses had amounted to £152,000, against £157,000, showing a decrease of £4,600. Part of this saving was due to the closing of the Tasmanian stations last year, and partly to the discontinuance of the special allowances granted to the staff affected when the Mexican dollar in the Straits Settlements was placed on a gold basis, and resulted in a diminution of their currency incomes. As, however, the cost of living in the Far East, particularly in the Straits Settlements, had risen very considerably during the last few years, it had recently been found necessary to substantially increase the remuneration of the staff in that region, in order to fairly meet the new conditions which had arisen. The shareholders must consequently be prepared, when the accounts for the current half-year were before them, to see an increased expenditure on this account instead of a reduction as on the present occasion. The net profit for the half-year was, roundly, £171,000, and after adding

£26,000 brought forward from the previous half-year there remained an available balance of £197,000. The usual quarterly interim dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, and £50,000 had been transferred to the general reserve fund, leaving a balance of £72,763 to be carried forward, as against £58,844 carried forward in the corresponding half-year of 1909, when no addition was made to the general reserve fund. As the reserve fund investments showed further depreciation during the past six months, principally in British railway securities, the directors had considered it advisable to make further provision on this account, and had, therefore, debited the general reserve fund with an additional £30,000, making a total provision against depreciation of £150,000. Statements having recently appeared in some of the newspapers regarding a proposal for the introduction of a reduced rate for deferred telegrams in plain language, the shareholders would perhaps expect him to make some reference to the subject. A proposal of this nature had been submitted by the British Postmaster-General to the various cable companies interested, and the matter was now under consideration. The facilities which were afforded under the International Telegraph Regulations for the use of code language in telegrams, enabled a very large economy in the cost of telegraphic messages to be made by those persons who were in a position to take full advantage of them, so much so that there was little or no ground of complaint with regard to the cost of coded telegrams. There were, however, certain classes of the community who, owing to the circumstances in which their telegrams were necessarily sent or to their not having previously arranged with their correspondents an agreed code, were compelled on occasions to use plain language. Such individuals were, therefore, practically prevented from deriving any benefit from arrangements as to telegraphic codes which were intended, in theory, to be open equally to all users of the International Telegraph System. This relative disadvantage of the users of plain language, though in many cases preventable, pressed hardly upon them, while it was, in point of fact, less troublesome as a rule for the telegraph service to transmit telegrams in plain language than telegrams in code, especially in those codes composed of "artificial words," which were so widely used. The object of the proposal of the Postmaster-General was to meet a much-felt social want which had been acknowledged by the company for some years, and which they in 1902 endeavoured to meet by compiling and publishing their "Eastern Social Code," to be kept available at all their stations for the use of the public. It was believed by the board that the revenue of the cable companies would not be adversely affected by the new proposal, provided that proper safeguards were incorporated with it to prevent the privilege being abused, and their associated companies had therefore agreed to the proposal in principle, leaving the necessary details to be worked out. This might, however, take some little time to accomplish. The shareholders would also be interested to learn that by arrangement with the British Government they were about to establish a wireless installation at their Keeling-Cocos station to enable telegrams to be exchanged between passing ships and this remote station. The necessary apparatus was now being sent out from this country for the purpose. The installation was expected to be in working order early next year, and the facilities thus afforded would doubtless be greatly appreciated and made use of by the many ships passing the Keeling-Cocos Islands. The erection of wireless installations was also contemplated at their Singapore and Hong Kong stations, but the details in connection with the licences for these installations had not yet been definitely arranged with the British Government.

The Marquis of Tweeddale seconded the motion.

Mr. Reich congratulated the directors upon the remarkably good results shown during the past half-year. He was, he said, very gratified to see that the working expenses had been reduced, but was sorry to hear the chairman say that they must not expect a further reduction next half-year. With regard to the £30,000 which they had written off for depreciation on their investments, he would like to know whether that represented the actual difference in the cost price and the price existing on June 30th. Seeing that the value of securities which the company possessed had been constantly depreciating, he suggested that the board might go in for short date securities, which, although they might yield a lower rate of interest, would not depreciate to anything like the extent that the gilt-edged stocks had.

The Chairman, in reply, said that they had not written down their reserve fund to any particular price, but the amount they had written off was an allowance for possible depreciation, which if they came to sell would very nearly represent the price to-day. Those prices, however, could not really be taken as the value of their investments. With regard to the question of investments generally, there was no doubt that matters were very unsatisfactory in regard to some of them—not so much their modern ones as those that were made many years ago when Consols were 15 or 20 per cent. higher than they were now. The depression in Consols was only an index of what had taken place in all British gilt-edged securities, and until they saw Consols again at something like the price they were 10 or 12 years ago, he could not hold out any hope that British railway and other like securities would rise to any appreciable extent. The board had always kept their eyes open for advantageous short date securities, and would continue to do so.

The report was adopted.

Mr. Stephens, in moving a vote of thanks to the chairman and directors of the staff, remarked that it was a matter of great satisfaction that wireless telegraphy, which a few years ago they looked upon as an enemy, had now been harnessed to the service of the company.

Mr. Reich seconded the vote, which was carried and briefly acknowledged by the chairman.

Berlin Electricity Works.

The report of the Berliner Elektrizitäts Werke for 1909-10, which has no competitors in the supply business in the German capital, states that the economic life experienced a further development, and the consumption of current increased in general. The reduction in the charges for lighting in the late hours of the night had attracted many customers, and the employment of prepayment meters in connection with free wiring had advanced the use of electricity among small consumers. On the other hand, the attempt to obtain large consumers by the supply of high-pressure current had succeeded, and the possibility of securing such a supply had in various cases prevented the establishment of independent installations, whilst in other instances existing generating plant had been stopped, and a supply procured from the company's mains. The number of consumers at the close of the year was 28,639, as compared with 24,786 on June 30th, 1909, and the connections in the 12 months rose from 164,364 KW., to 183,222 KW., of which lighting represented 74,864 KW., and power 108,358 KW. Including own consumption, the sales amounted to 174,430,000 KW.-hours, as contrasted with 157,890,000 KW.-hours in 1908-9, the tramways alone having absorbed 59,230,000 KW.-hours of the former total. The electric motors in the suburbs of Berlin reached 24,864, of 82,220 H.P., and the number of private accumulator installations was 46, as against 44 in the previous year. The average proceeds realised in Berlin, after deducting the taxes to the local authorities, amounted to 15·57 pfennings per KW.-hour, as compared with 15·98 pfennings in 1908-9. The following figures are shown in the accounts for the past two years:—

	1909-10.	1908-9.
Ordinary share capital	£2,205,000	£2,205,000
Preference (4½ per cent.) shares	1,000,000	1,000,000
Debentures	2,398,000	2,423,000
Gross profits	808,000	708,000
General expenses	76,200	68,400
Renewal fund	24,000	22,000
Depreciation	219,000	201,000
Net profits	486,000	403,000
Profit share of municipality	155,000	124,000
Dividend on ordinary shares	242,000	198,000
" " " per cent.	11	11

According to investigations made by the company the substitution of direct-current turbo-dynamos for the piston engines is technically practicable and of advantage from an economic point of view. As consent had been obtained to defray a portion of the cost out of the renewal fund, it is now intended, in the first place, to replace two steam engines in the Schiffbauerdamm station by two direct-current turbo-dynamos of 3,600 KW. combined capacity, and a similar reorganisation is proposed in the central station in the Mauer Strasse. The report further mentions that the Teltow local authority has stopped working its station on the Teltow canal, and leased it jointly to the Berlin Electricity Works and the Berlin Suburban Electricity Works, and extensions of the supply to other districts are either in progress or in contemplation.

West India and Panama Telegraph Co., Ltd.—The report for the half-year ended June 30th states that the amount to credit of revenue is £43,523, against £38,560 for the corresponding half-year, and the expenses have been £24,636, against £25,068. There is, therefore, a balance of £18,887, making with interest on investments and the amount brought forward, a total of £21,240. The directors propose the payment of 15s. on the second preference shares—viz., 9s. balance, accrued to December 31st, 1909, and 6s. for the six months ended June 30th, and a dividend of 1s. per share, tax free, on the ordinary shares. £1,000 is placed to reserve, and £1,953 is carried forward. The traffic receipts for the six months show an increase of £4,649. The cables continue to be maintained in good working order.

Compagnie Francaise des Tramways Electriques et Omnibus de Bordeaux.—The directors have decided to pay 4.80 fr. on the registered shares.

British Coalite Co.—It is officially stated, says the *Times*, that the Barking works, which were closed down some weeks ago for reorganisation and repairs, have been restarted, and are now operating at full capacity.

Northern Light, Power and Coal Co., Ltd.—According to the *Financier*, the progress report of this company states that in June, 1909, the company offered $1,750,000 5 per cent. gold bonds, and the greater part of the proceeds of this issue has been applied as follows:—In the erection of an 8,500 H.P. plant near Dawson City, Yukon Territory; the installation of a 44-mile transmission line from the power station to Dawson; the development of the company's collieries, and the carrying out of alterations and improvements necessary to place the product of these collieries on the market. This work has now been practically completed, and since August 24th, 1910, power has been generated, transmitted and sold to large and responsible power consumers. The coal is being mined, transported to Dawson, and there sold at remunerative prices. In addition, roads have been built, a short transmission line constructed to supply the Yukon Gold Co. with power, the company's railroad brought up to date, and other works completed.

Continental.—France.—La Société d'Applications Industrielles (Compagnie d'Entreprises Electriques) of Paris reports a profit of £9,475 for the past financial year, as compared with only £4,851 in the preceding 12 months. A dividend of 4 per cent. is being declared.

Cape Electric Tramways, Ltd.

The directors' report for the year ending June 30th, 1910, states that the profit and loss account, after providing for debenture interest and redemption of debentures, and taking into account the balance brought forward, shows a balance to credit of £9,048, which has been carried forward. During the year the tramways carried in Cape Town 12,207,739 passengers, earning £119,936, against 11,888,180 passengers, earning £117,715, for the preceding year. In Port Elizabeth 3,102,286 passengers were carried, earning £32,883, against 2,978,217 passengers, earning £31,455, for 1908-9. The profits of the past year earned by the sub-companies compare with those of the preceding year as follows:—Profit for year 1909-10, credited to profit and loss account, £52,846, plus the following extraordinary items of expenditure charged against that period, viz.:—Cape Town: Expenditure southern suburbs sidings, £1,089; share of profits due to the Municipal Councils of Cape Town and Sea Point from 1906 to 1910, £2,901; special depreciation of live stock, &c., £167 = £4,157. Port Elizabeth: Balance of losses remaining on account of the extraordinary floods of November, 1908, £4,397; investment in Humewood skating rink, £100 = £4,497, making £8,654; the total being £61,501. The profit for year 1908-9, credited to profit and loss account, is £47,029; to which is added proportion of flood expenses at Port Elizabeth charged against that period, £1,409 = £48,438; showing an increase for the year 1909-10 of £13,063. This greatly improved result justified the writing-off the total amount remaining of the flood losses at Port Elizabeth, which it had been originally intended should have been spread over a period of years. The period of financial depression in the Cape Province generally is now passing away, and both the tramway systems in Cape Town and in Port Elizabeth have shown a satisfactory expansion of traffic, which is being well maintained in the current months of the new year. Appended to the report are extracts from the reports of the general managers at Cape Town and Port Elizabeth giving details regarding the operation of the undertakings. The total claims arising from accidents during the year for both Cape Town and Port Elizabeth amount to a total of £106, being a record minimum sum under this head, which is a striking testimony to the efficiency of the general managers, Mr. Giles and Mr. Barkley, and of the staff working under them.

The directors express their regret at the death of Col. Sir Charles Euan-Smith, K.C.B., C.S.I., who had filled the office of chairman of the company from its incorporation.

Mr. Ludwig Breitmeyer was appointed chairman.

Cordoba Light, Power and Traction Co., Ltd.

The second annual general meeting of this company was held on Monday, at the offices, 62, London Wall, E.C., under the chairmanship of Sir J. Irving Courtenay.

The Chairman, in moving the adoption of the report, said that the accounts of this, their second year, showed what he thought they would agree was a satisfactory result, considering that so large a part of their capital had not yet come into earning power. The net profit was £17,507, compared with the profit of £13,410 shown by the accounts a year ago. This profit enabled them to recommend a dividend at the rate of 3 per cent. on the shares, being an increase of 1 per cent., while they carried forward £8,202, as compared with £4,867. As regarded the construction work now being carried out by the two subsidiary companies, active progress was being made by the contractors, Messrs. J. G. White & Co., with the work upon the Calera hydraulic installation, which was an installation comprising about three miles of canals, pipe lines and tunnel, and was designed to generate about 6,000 h.p., which power was to be transmitted some 15 miles to the city of Cordoba. So far as could be judged at present the first portion of that power should be available by about September next year, and the whole by end of the year 1911. With regard to the electric tramways, they had also to note good progress, as they had 14½ miles constructed and 12 miles in operation, as compared with 6½ miles constructed and 4½ miles working at this time last year. Had it not been for the fact that the construction had been somewhat delayed by the negotiations regarding the new concession, they would have still further progress to report. Some part of the work had to be held up until the concession had been definitely granted, as it, to some extent, modified the routes of the systems they were now combining. The new tramway concession was granted last month, and its actual details as finally agreed had only come to hand that morning. It was for a term of 75 years from the present time, it provided for the electrification of the combined systems now owned by their Tramways Co., and instead of the 6 per cent. of the gross receipts, which they now paid to the municipality, they would for the next five years pay only 4 per cent., and then for the 15 years ensuing 5 per cent. They considered that great credit was due to the manager, Mr. D'Abbadie, for the manner in which he had handled the negotiations in connection with this concession. It would enable them to consolidate their systems and work them with greater economy, while at the same time supplying the city with a more efficient service. Pending the obtaining of the concession for their electrification, the Ciudad de Cordoba tramways had been operated by horse traction since they were taken over on January 1st, 1910, and it had been possible to considerably improve the working. The returns had shown a satisfactory yield on the capital invested in this tramway, and after conversion to electric traction they should be still further augmented. In the report they gave the figures of the units of electrical energy disposed of for private lighting and power by the Light and Power Co. during the months of April to August in the years 1909 and 1910, and mentioned that the increase this year was equal to one-third of the total sales of the same five months in 1909. The sales of the Light and Power Co. had shown a steady annual increase for at least seven years past, and everything pointed to continued advance in the future. It was interesting to know that the increase in the combined net receipts of the Light and Power Co. and the Tramways Co. for the first six months of the current financial year showed an increase of nearly 52 per cent. over the corresponding period of the year 1909. He should explain that there was an exceptional circumstance which materially helped that result, and that was the special illuminations for the Argentine Centenary celebrations in the month of May last, but if they excluded the additional profits arising for those illuminations, the increase was still 37¾ per cent. He could not promise that this increase would be maintained throughout the year, for they had been, to some extent, temporarily deprived of their water supply. As he had explained on a previous occasion, the waters of the River Primero, from which the Cordoba Light and Power Co. derived its hydraulic power, were impounded by one of the largest dams in the world. The Government of the Province of Cordoba, who built the dam, decided that it required certain repairs, and in order that these might be executed, they emptied the dam at the end of August. They had cabled advices that this work was completed on 3rd inst. Practically the whole of the 2,000-h.p. steam plant was now in operation, so that there should be no difficulty in maintaining the full load during such time as there was no water available. In order to complete the hydraulic works of the Light and Power Co. now in progress at Calera, to install further auxiliary steam plant, and to complete the electrification of the tramways, it had become necessary for them to provide further funds. As was explained in the circular sent to the shareholders in connection with the extraordinary meeting held last June, the sum which they estimated would be required was £350,000. Satisfactory financial arrangements had been made for the purpose of carrying on the construction now in progress by means of the borrowing powers arising from the increase of capital authorised last June. Having given this *resumé* of their present position, he thought they were justified in considering the company a progressive one.

Mr. T. Freme-Thomson, in seconding the motion, said it was interesting to note that the new tramway concession was for 75 years from this date, which meant that they started afresh again. The old concession was for 75 years.

The motion was carried without further discussion.

The Chairman paid a tribute to the excellent work of the staff in Cordoba.

Official Announcements re Companies.—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Accessible Battery and Engineering Co., Ltd.
Ashford and District Electric Supply Co., Ltd.
Atlas Tube and Fittings Co., Ltd.
Automatic Circuit Breakers, Ltd.
Automatic Smokeless Furnace Co., Ltd.
Automixte, Ltd.
Bastian Mercury Vapour Lamps, Ltd.
"Boon" Variable Gear Syndicate, Ltd.
British Accumulator Co., Ltd.
British Arc Lamps, Ltd.
Camberley Electric Supply Co., Ltd.
Chinnery's Advertising Signs, Ltd.
Conduits and Fittings, Ltd.
Crawford Electric Lamp Syndicate, Ltd.
Ekstromer Accumulator Co., Ltd.
Electrical Mining Co., Ltd.
Electrical Loco Motor Propulsion Co., Ltd.
Evaporation and Smoke Condenser Co., Ltd.
Explosive Turbine Syndicate, Ltd.
Farnham and District Electric Supply Co., Ltd.
General Electric Inspection Co., Ltd.
Glover's Water-Tube Boiler Co., Ltd.
Gould Storage Battery Co., Ltd.
Hay Boiler and Engineering Co., Ltd.
International Telescriptor Syndicate, Ltd.
Mercedes Petrol Electric Co., Ltd.
Modern Traffic Development Corporation, Ltd.
Light and Heat Co., Ltd.
New Process Wire Drawing Syndicate, Ltd.
Nottingham Electrical Co., Ltd.
Phillips Railway Signalling Syndicate (1907), Ltd.
Red Cross Light Cure Institute, Ltd.
Scotch Water Power Syndicate, Ltd.
Shippey Bros., Ltd.
Simplex Gas Engine Starter, Ltd.
Simplified Underground Conductor Co., Ltd.
Smokeless Coal Co., Ltd.
Telephonic Bell Push Syndicate, Ltd.
Traction Corporation, Ltd.
Universal Insulator, Ltd.
Wilson Thom Canal Power Syndicate, Ltd.

Stock Exchange Notices.—The Committee has ordered to be officially quoted, and has appointed Thursday, November 17th, a special settling day, in—

Anglo-Argentine Tramways Co., Ltd.—Scrip, fully and partly paid, for £1,500,000 5 per cent. debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Montreal Water and Power Co.—Further issue of £25,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 3,128 to 3,157, 4,906 to 5,000, and 6,273 to 6,397.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended September 30th, 1910, were 1,105,049, compared with 974,050 units in the corresponding five weeks of 1909.

MARKET QUOTATIONS.

Wednesday, November 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£9 10	..
a Copper Sulphate	"	£18	..
a Lead, Nitrate	"	£25	..
a " White Sugar	"	£23 10	..
a " Peroxide	"	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	88/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %)	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a " Cyanide (basis 100 %)	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b " Wire, in ton lots	"	£112	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6¼d.	..
c " Tube (brazed)	"	8¼d.	..
c " " (solid drawn)	"	7d.	..
c " Wire, basis	"	6¼d.	..
c Copper Tubes (brazed)	"	9d.	..
c " " (solid drawn	"	8¾d.	..
g " Bars (best selected)	per ton	£73	£3 inc.
g " Sheet	"	£73	£3 inc.
g " Rod	"	£73	£3 inc.
e " (Electrolytic) Bars	"	£60	..
e " " Sheets	"	£76	..
e " " Rod	"	£63 15	..
e " " H.C. Wire	per lb.	8d.	..
f Ebonite Rod	"	6/-	..
f " Sheet	"	5/6	..
n German Silver Wire	"	1/11	..
h Gutta-percha, fine	"	..	..
h India-rubber, Para fine	"	6/1	3d. inc.
l Iron Pig (Cleveland warrants)	per ton	49/5	3d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£13 7 6 to £13 10	7/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8	12/6 dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	160/-	6/- inc.
e Silicium Bronze Wire	per lb.	9d.	½d. inc.
r Steel Magnet, in bars	per ton	£65	..
g Tin, Block (English)	"	£165 to £166	£9 inc.
n " Wire, Nos. 1 to 16	per lb.	1/10½	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

The Austrian Lamp Trade.—It is proposed to convert the Watt Glow-Lamp Factory, of Vienna, into a limited company. Negotiations on the subject of financing the undertaking have been proceeding with the Union Bank, but they have not matured, as the owners asked a purchase price which the bank considered to be too high. The firm now intends to enter into negotiations with other banks on the matter.

Electrical Motor Vehicle for Powder Transport.—An interesting electrical motor vehicle has recently been completed by the Studebaker Automobile Co., of South Bend, Indiana, U.S.A. The interest lies in the fact that it is intended for the transport of powder, the vehicle having been built to the order of the Union Metallic Cartridge Co., of Bridport, Conn., U.S.A. The compartment in which the powder is carried is practically hermetically sealed, and is constructed in such a way that the use of metal which might cause friction and consequent ignition is entirely avoided. The speed controller and other portions of the mechanism at which sparking is likely to occur, are immersed in oil, and all the wiring is enclosed in metallic conduits.

STOCKS AND SHARES.

Tuesday Evening.

Markets are quiet in the main, but steady. There is a certain amount of investment buying about, and the elections in the United States this week have given the American market plenty of work. Amongst the electricity departments the principal changes are the advances in British Columbia Electric Railway stocks.

The regretted death of Sir Clifton Robinson removes a familiar figure from the giants of the tramway world, and had it occurred some years ago, the effect upon some of the Stock Exchange prices would have been considerable. But latterly, of course, Sir Clifton Robinson has not been much concerned with the practical management of the companies with which his name is most closely identified, and the severance of his connection with the London United Tramways removed him from the platform to which most City attention is turned.

London United Tramways Preference shares fell ¼ as a result of Sir Clifton's death.

Cape Electric Tramways remain at 7s. 6d., in spite of a much more satisfactory report which came out the other day. If the company could do so well in what may be called normal times, it should be able to secure still better traffics during the current six months, when political excitement and the Royal visit are extra factors making for improvement.

Metropolitan Electric Tramway Debenture stock has risen 1, and Underground Electric Railway 4½ per cent. bonds are a point higher. The Prior Liens are *ex* coupon, and, consequently, 2½ down.

Of the Home Railway stocks, one of the most interesting this week is East London, which has risen to 4 on vague hints—it must be for the seventy-seventh time—of electrification. Curiously enough, the junior Debenture stocks have not moved. The "B," "C" and "D" issues started at 24, 6 and 5 respectively, and, taking the whole amounts of each at these figures, they worked out to an aggregate of about £160,000. There ought to be scope for talent here on the part of some American millionaire.

East Londons and Districts are amongst the few Home Railway stocks which have rises to their credit this week. City and South London Ordinary lost ½, and so did Metropolitan Consolidated, while the Surplus Lands went back a point. Labour troubles in various industrial areas are frightening investors from this market, where even the splendid Board of Trade Returns went for practically nothing so far as assistance to prices was concerned.

The Great Eastern Railway has denied the rumour that any immediate electrification of its suburban service is intended.

Charing Cross Electricity Supply shares are ⅛ higher, while Chelseas and Westminsters are down by a similar fraction, this completing the list of changes in the Home Department of the market. Mexican Light and Power Common is 2½ higher, and the Preferred as well as the bonds gained ½. On the other hand, Electrical Development of Canada Fives are ½ lower, and ¼ fall occurred in Mexican Electric Light Fives. Mexico Trams have improved, Rios keep about 106, with a good deal of business doing in them, and Sao Paulo Trams are harder at 155. Para Electric Tramways 5 per cent. First Debenture stock has been changing hands with freedom at fractions over par. Anglo-Argentines are active, but without quotable changes. Canadian General fell 3 to 111; Shawinigan at 112½ is 1½ up.

The main feature in the telegraph market is the steadiness that prevails throughout the list, which has resulted in a fair number of rises. West Indian Panama rose nearly 2s., and both Preferences went up ¼ on the declaration of a dividend of 1s. a share on the Ordinary. The Debentures at 102½ are also harder. In the American group the excitement in connection with to-day's Election in the United States brought about a sharp rise in American Rails, which was reflected in a further improvement in Anglo-American Telegraph Deferred stock. American Telephone and Telegraph has risen ½, and the rumours as to the working agreement between these two and several other companies are as persistent as ever. Direct United States shares, however, continue dull, and Direct Spanish Telegraph Ordinary fell ¼. There has been a rise of ⅜ in Amazon shares, and a gain of ⅛ stands to the credit of Reuters.

There is a good deal of buying of National Telephone issues, and the Deferred stock rose 2 points upon a comparatively small inquiry. The other five issues are also better, but the 4 per cent. Debenture stock sticks at par, which, of course, is about all it is intrinsically worth. No other changes of importance have occurred amongst telephone shares.

In the industrial list, Electric Construction Preference have risen to 35s., and the Ordinary to 13s. 9d. on the reasons at which we hinted last week. The Debenture stock is 4 up, and quoted at 64½, but it can very readily be sold. There are several buyers of whatever amounts come to market. General Electric Preference went up 15s. to 8½ on the consideration of the good yield which can be obtained from the shares, and the increasing prosperity of the company. British Westinghouse 4 per cent. Debentures eased off to 60½, and beyond this there have been practically no changes. Rubber has been rising a little just lately, touching 6s. 3d. per lb., and in consequence of this the Rubber share market has enjoyed additional strength. Expert opinion from Liverpool suggests that for another 12 months or so rubber will be cheap at 5s. 6d. and dear at 7s. 6d., so that if this view is borne out it seems likely that the market for the raw stuff may settle down on to a steadier basis, instead of indulging in the wild fluctuations that it has undergone this year.

British Columbia Electric Railway Deferred recovered 7½ of the fall which took place on the last new issues.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Nov. 1st.	Closing Quotations Nov. 8th.	Business done week ended Nov. 8th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	4¼ — 4⅝	4⅜ — 5⅛	97/6	.	+ ⅜	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95½ — 97½	95 — 97	..	..	..	5 2 7
255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	144 —147	145 —148	145	..	+1	5 8 1
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94⅛ — 96⅛	95⅝	95¾	+ ⅛	4 2 11
558,460	Anglo-American Telegraph	Stock	3¾%	3¾%	£3 4s.	3¾%	66 — 68	66 — 68	66½	66½	..	5 6 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106¼—108½	106¼—108½	108	106	..	5 10 7
3,220,770	Do. do. do. Deferred	Stock	1¾	1 %	8/-	25/-	26⅝ — 27¼	27⅛ — 28	27 13/16	27	+ ¾	4 9 3
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9⅝ — 10¼	9⅜ — 10¼	..	..	..	3 18 1
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	85⅜	..	..	4 12 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8⅛ — 9⅛ xd	8¼ — 9⅛	8 1/16	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅝ — 17⅛ xd	16⅝ — 17⅛	17	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝ — 3¾	3⅝ — 3¾	..	..	..	5 1 7
6,000	Do. do. 10 % Cum. Pref. ..	10	10 %	10 %	10 %	10 %	8¾ — 9	8¼ — 8⅝	..	..	— ¼	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
60,710£	Direct United States Cable	20	4½%	4½%	4½%	4 %	15⅜ — 15⅝	15⅜ — 15⅝	15 11/16	15⅜	..	5 1 3
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	130 —133	130 —133	132½	130½	..	5 5 3
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83 — 85	83 — 85	84¼	..	..	4 2 4
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	101 —103 xd	101 —103	101¼	100½	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12½ — 12¾	12½ — 12¾	12⅝	12 5/16	..	5 10 11
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000£	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	99 —101 xd	..	..	..	3 19 3
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	5⅛%	10¼ — 10⅜	10¼ — 10⅜	10 9/16	10 5/16	..	5 9 5
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	13¼ — 13⅜	13¼ — 13⅜	13 9/16	13⅜	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	18 %	30⅝ — 31⅜	30⅝ — 31⅜	..	..	— ⅛	5 14 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52½ — 54½	52½ — 54½	..	..	..	5 19 4
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	94 — 97	94 — 97	..	..	..	4 7 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	..	..	..	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ⅞	⅜ — ⅞	16/9	16/3	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	¾ — 1 xd	¾ — 1	18/-	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1 5/16 — 1 7/16 xd	1 5/16 — 1 7/16	16/9	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104½—105½	105 —106	105⅞	104⅞	+ ⅛	5 13 2
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	121 —123	123 —125	124⅝	121¼	+ 2	4 16 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10⅛ — 10⅜	10 1/16	..	+ ⅛	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10⅛ — 10⅜	..	..	+ ⅛	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 3/16 — 5 5/16	5⅜ — 5½	5⅜	5 5/16	+ 1/16	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98½ —100½	99½	98½	+ ½	3 9 8
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	89	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98 —100	98½—100½	..	..	+ ⅛	3 19 7
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8	7⅞ — 8⅛	..	..	+ ⅛	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	99¼	..	..	4 9 1
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	6 %	130—133	130 —133	..	..	..	4 10 3
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7¼ — 7⅜	7¼ — 7⅜	7 5/16	7 1/16	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	2½%	1⅛ — 1⅜	1 1/16 — 1 1/16	22/6	..	..	4 12 8
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98½—100½	..	..	+ ½	3 19 7
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅜ — 14¼	13⅜ — 14¼	14	13⅞	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100—102	100—102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1⅜ — 1 7/16	1 5/16 — 1 5/16	25/-	23/9	+ ⅜	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	9¼ — 10¼	10 — 10½	10⅛	..	+ ⅛	5 14 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	9¼ — 10	9⅜ — 10¼	..	..	+ ⅛	6 0 0
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101⅛—103⅛	102 —104	..	..	+ ⅛	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4⅜ — 5	4⅜ — 5	99/4½	96/3	..	5 0 0
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4½ — 4⅝	4½ — 4⅝	93/9	91/10½	..	5 5 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	92 — 93½	92 — 93½	93½	92½	..	4 5 7
932,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	24 %	5⅜ — 5⅝	5⅜ — 5⅝	5 7/16	5⅜	+ ⅛	4 3 1
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	136 —140	143½—147½	145½	139½	+ 7/8	5 8 6
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	116 —120	120 —124	122	119⅜	+4	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109½—112½	111½	110½	+ ½	4 8 11
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	103½	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	⅝ — 1	⅝ — 1	16/-	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1¾%	Nil	3⅛ — 3⅜	3⅛ — 3⅜	66/3	..	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	88 — 92	89½	88½	..	5 8 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	69 — 74 xd	69 — 74	..	..	..	6 0 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6¾ — 7¼	6¾ — 7⅛	6⅞	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6½	6 — 6½	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
201,579£	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	59 — 62	..	..	—1½	6 9 1
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000£	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	37 — 42	37 — 42	..	..	..	10 14 4
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	18 19 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4½ — 5	4½ — 5	95/-	91/3	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	5	..	..	4 17 7
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9 — 9½ xd	9 — 9½	..	..	..	5 2 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4 13/16 — 5 1/16	4 15/16 — 5 1/16	5⅛	..	..	4 5 9
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	103½—105½	104 —106	..	..	+ ⅛	4 4 11
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	3⅛ — 3 5/16	3⅛ — 3 5/16	63/6	62/6	..	3 19 4
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —108	106⅜	..	..	4 3 4
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	62 — 64	62 — 64	63½	62½	..	4 13 9
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	+1	4 12 0
554,665	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	44 — 46	44 — 46	46	44½	..	4 7 0
1,488,000	City and South London Railway	Stock	2½%	2½%	1¼%	1¾%	27⅛ — 28⅛	27 — 28	27½	..	— ½	6 5 0
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
100,000£	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	83 — 86	83 — 86	..	..	..	5 17 8

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Nov. 1st.	Closing Quotations Nov. 8th.	Business done week ended Nov. 8th, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	5 %	7/— 1	7/— 1	..	..	..	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	32/— 1 3/32	32/— 1 3/32	..	..	..	5 11 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½— 13½	12½— 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	0 — 1/8	0 — 1/8	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½%	2½%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	65	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	77 — 80	77 — 80	..	..	..	6 5 0
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/— 1/8	3/— 1/8	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1½— 1¾	1½— 1¾	23/1½	..	+ 3/16	7 9 4
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7⅞— 8	8¼— 8⅜	..	..	+ ⅛	5 14 3
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	⅓%	Nil	Nil	3/— 1	3/— 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼— 10⅜	10¼— 10⅜	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103¼	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12¼— 12⅝	12¼— 12⅝	12⅝	12¼	..	5 17 8
40,000	Do. do. 4½ % Pref.	100	4½%	4½%	4½%	4½%	5 1/16— 5 3/16	5 1/16— 5 3/16	5 3/16	..	..	5 4 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½— 15½	14½— 15½	15⅛	15⅛	+ ¼	6 9 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	⅓%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	6⅞— 6¾	6⅞— 7¼	..	..	+ ⅜	6 17 11
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1¼— 2⅛	1¼— 2⅛	..	..	..	Nil
399,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½— 2⅛	1½— 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅓%	..	1⅝— 2⅛	1⅝— 2	37/3	..	— ¼	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	..	..	..	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	½%	½%	1 %	38⅛— 38⅜	37⅞— 38⅛	38⅜	38	— ⅛	2 12 4
2,640,914	Do. Surplus Lands	100	23⅛%	23⅛%	23⅛%	23⅛%	66 —68	65 — 67	66½	65½	—1	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	22⅞—23¼	23 — 23½	23⅛	23⅛	+ ¼	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	5%	3/— 7/16	3/— 7/16	..	..	..	5 14 3
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/— 3/16	1/— 3/16	2/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/16— 29/32	15/16— 29/32	..	..	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	97 —100	98⅜	98½	+ ⅛	4 10 0
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	124⅛—126⅞	125 —127	126⅜	126⅛	+ ⅛	4 14 6
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	97⅞— 98⅜	97⅞— 98⅛	98¾	98	— ⅛	5 1 6
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/— 7/16	3/— 7/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16— 13/16	11/16— 13/16	..	..	..	7 5 5
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	35¾— 37½	36 — 38	37½	36	+ ½	5 10 3
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 — 103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	102⅛—103½	100 —101 xd	101	100⅛	..	4 19 0
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	92 — 94	93 — 95	94	93½	+ 1	4 14 9
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	37 — 39	37 — 39	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/— 3/8	1/— 3/8	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1 — 1½	1 — 1½	..	..	..	10 0 0
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6⅞— 7⅛	6⅞— 7⅛	7 3/16	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅜— 3⅞	3⅜— 4	76/3	74/4½	+ ⅛	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	87/6	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅜— 4⅛	3⅜— 4⅛	..	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3¾— 4	3⅜— 3⅞	68/9	..	— ⅛	5 16 2
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅛— 11⅝	11⅛— 11⅜	11 7/16	11⅛	..	6 5 10
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛— 12⅛	11⅛— 12⅛	12	11⅜	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½—102½	99¼—102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½— 2	1½— 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅝— 3⅛	2⅝— 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½— 96½	94⅜— 96⅜	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜— 7¾	7⅜— 7¾	7⅛	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅞— 11¼	10⅞— 11⅛	10⅝	10⅜	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	104½—107½	104⅛—107⅛	..	..	..	4 3 9
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —101 xd	98 —101	100½	..	— ⅛	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	3/— 3/8	3/— 3/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1⅝— 2	1⅝— 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	75 — 78	75 — 78	77	76½	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	82 — 85	81⅛— 84⅛	83	82¾	— ⅛	5 18 4
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..	4 11 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	6⅞— 7⅛	6½— 7	..	..	— ¼	6 1 5
$1,976,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	101⅛—103½	101⅛—103½	..	..	..	4 16 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅞— 7⅛	6⅞— 7¼	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅜— 1⅞	1⅜— 1¾	..	..	..	4 16 0
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅞— 5⅛	4⅞— 5⅛	98/9	97/6	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4⅛ %	4½%	4 %	4 %	90 — 93	90 — 93	92	91½	..	4 6 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3⅛— 3⅜	3⅛— 3⅜	70/-	68/9	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..	4 17 4
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	89½— 90½	89¼— 90¼	90	89½	— ⅛	5 10 10
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	88 — 89	90⅞— 91¼	91	89⅛	+ 2⅛	4 7 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	105 —106	105⅝—106⅜	106⅛	105⅝	+ ⅛	6 11 5
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	92½— 93⅛	93 — 94	93⅝	92¼	+ ⅛	5 6 5
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3⅜— 4⅛	3⅜— 4⅛	..	..	..	2 12 9
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	97½— 99½	97½ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	12 1/16	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅜— 6⅝	6⅜— 6⅝	..	..	..	5 3 8
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	220 —230	225—235	..	..	+ 5	3 3 5
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	100 —110	100—110	..	..	..	5 9 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100⅛—102½	100⅛—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅝— 8⅛	7⅝— 8⅛	7⅞	7⅞	..	6 2 2
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	4 14 1
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	85½	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1½— 2	1½— 2	31/3	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝— 3	2⅝— 3	..	..	..	6 13 4
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	3/16— 1/4	3/16— 1/4	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅜— 1½	1⅜— 1½	..	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾— 1	¾— 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	45/-	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/— 7/16	3/— 7/16	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 — 8½	7⅝— 8⅛	7⅞	7⅝	— ⅛	5 19 5
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 5 per cent. October 20th, 1910.

PRIVATE POWER PLANTS AND THE PUBLIC SUPPLY.

[COMMUNICATED.]

The most difficult of all new business problems is, as a general rule, that of negotiating the closing down of a private power or lighting installation. Work of this class calls for a very complete technical and commercial knowledge of power generation in every form, in order that the weak spots of the plant in question may quickly be recognised, and so that the two costs on either system may be readily worked out and put before the user in a convincing manner. Success will depend entirely upon this, and the first and most important step in securing for the supply a load hitherto run by a private plant, or in persuading a power user to scrap his gas or steam engines in favour of motors, will be to arrive at an *accurate* idea of his total costs. Accuracy is emphasised, because the estimation in question is usually a difficult one to make, owing to the numerous details of operation for which no money or other figures are available. Unbusinesslike as it appears to the electrical engineer schooled in the most minute determination of carefully allocated costs, the average power user or possessor of a private plant has only the haziest idea of what that power or plant is costing him. He will seldom be found to admit it, but such is the fact, and his convictions as to the economy of his plant are often hard to shake. It must have been the experience of all who have had dealings in such matters to have met otherwise smart business men who will not recognise wages costs, because the work of attention is supposed to be done in spare moments by odd employés; others will contend that oil and engine room stores are negligible upon the grounds that they use so much elsewhere in the works; and cases have been known where even the coal item has been dismissed in the same cursory manner, the argument being that where quantities of fuel are of necessity used, as in the brewing and similar industries, the amount taken by the electric light plant is of no consequence. As for the losses which occur in long lines of shafting and belts, in leaky steam joints and bare pipes, these are always much under-estimated if not entirely ignored, and difficulty will generally be found in obtaining a proper recognition of their magnitude. In many cases persistent argument, backed up by examples, will have the desired effect, but at times it will be necessary to go farther and obtain permission to indicate the engines in order to show up shafting losses, and to conduct plant efficiency tests to arrive at a correct figure for the coal and water items. This is done as a matter of course by the larger American supply companies, and has been found productive of excellent results. The fact is clear that the average possessor of a private plant does not know how to figure up his costs, and recognising this it is an excellent plan to prepare a schedule setting forth the items which should rightly be charged to the cost of generation, &c. In the case of the average private plant employing steam power, these items may be taken as follows:—Fuel, water, removal of ashes, oil, waste, and engine-room stores, wages, office charges, boiler, engine, dynamo, and other repairs, upkeep of tools, rental value of space, insurance of plant, insurance of employés, interest on capital, depreciation.

In individual cases it may be found that other items should be included, such as compensation to neighbours for vibration, and fines for smoke, and in some instances, no doubt, certain items might be deleted. Where gas or oil plant is used, the above list, of course, requires a certain amount of modification, but it will serve very well in any case as a groundwork upon which, to erect the schedule. Taking certain points in detail, the first which calls for remark is that of office charges. Whatever the owner may say to the contrary, these are quite appreciable in an installation of any size. A certain amount of somebody's time is taken up in arranging coal contracts, storekeeping, watching the efficient running of the plant, and such like; and although this may only mean a few pounds a year, that is no reason why it should be entirely ignored, as that time might, and probably would otherwise, have been put in on other branches of the work. The repairs item is one likely to give difficulty, as in the majority of instances no record of any sort is kept of small renewals. Still, it must be insisted on, in spite of any amount of disclaimers to the effect that the item is negligible, and this is just where a thorough engineering training comes in and proves so invaluable to the representative. Experience will suggest certain small, but constantly recurring, items of expenditure which cannot be denied, and they will soon mount up to a sum worth taking notice of. Rental value of space is sometimes a very telling item, and excepting where there is much superfluous room, it is one that cannot be evaded. In several cases in London particularly, the writer has known this to be the turning point of the whole question, as it has amounted to a considerable sum. Unfortunately, the figure is usually difficult to arrive at, or, at any rate, to agree; it is so entirely dependent on the locality and the peculiar conditions of the case that no guide can be given. Insurance of plant and employés are items generally easy to score on, and the 1907 Employers' Liability Act will be found a strong inducement to get rid of dangerous machinery. This Act operates favourably to the wholesale supplier of power, since it provides the argument that by doing away with plant requiring attention, a manufacturer is also able in many cases to discharge hands who are always potential claimants. The interest on capital item does not appeal to the man who has already sunk money in generating machinery, but it is of consequence where he is wavering between putting down a plant or taking the outside supply. A fair and usual figure is 5 per cent. Depreciation may be fixed at from $7\frac{1}{2}$ per cent. to 10 per cent., but the owner will, of course, have his own ideas on that point, and it may be necessary to accept the figure he has always used.

To secure power business it is sometimes necessary to take risks, and owing to the very natural hesitation of the power user to scrap workable plant and incur considerable expenditure, it is occasionally imperative to give a guarantee that the cost of operation shall not exceed that of his old machinery, the convenience and all other merits of a supply from the main, attendant upon electric power as compared with gas engines, being thrown in. Several power companies have closed contracts upon the basis of a fixed annual payment representing a certain proportion of the former plant cost, and irrespective of the number of units consumed. This method is not necessarily a risky one, since a very close estimate of the consumption is possible in most cases if the matter is thoroughly investigated by experienced men. Ethically, perhaps it is not a desirable system, but the fact remains that some companies are making a better thing out of such arrangements than they would if the supply were charged upon a consumption basis, and at the same time are satisfying the consumer with a lower annual power bill than he previously paid. It may be necessary to go so far as to put in motors and temporary wiring, free of charge, on trial for three or six months, agreeing to take them out if unsatisfactory, or to sell or hire-purchase them at a certain figure if approved of. Here, again, the risk appears greater than it really is. Experience shows that in only a very small minority of cases are the motors, installed on such a scheme, rejected at the end of the term, and if the worst comes to the worst, they will always be useful elsewhere, and the only money lost is that represented by labour, and perhaps the wiring. It is not unreasonable to ask the consumer to provide belting and foundations if the latter are necessary, or, indeed, to stipulate that he should pay for the temporary wiring. It is the thin end of the wedge that is so often difficult to drive in. If only a single trial motor can be forced on the consumer, it is worth a lot of work, as nearly always it is followed by the installation of others, until the whole factory is in time converted. The same result is found in private lighting plants. If an extension circuit or two can be picked up by the public supply, the comparative reliability and freedom from bother will soon tell in its favour. Perhaps the royal road to the desired end, both in the case of an engine-driven factory and a private generating plant, is that laid open by a bad breakdown. To come to the rescue promptly and effectively is to make a friend, and, almost invariably, a convert. Such a chance should under no circumstances be missed, even if it entails night and day work and an actual loss on the transaction. The

advertisement obtained through the local Press and other means of publicity is of the utmost value, worth many times over the few pounds it may cost.

An obstacle which frequently stands in the way is the disposal of the scrapped plant—usually a difficult matter, particularly if it is at all antiquated. In, perhaps, the the majority of instances it will only fetch scrap prices, but if the supply authority can in any way assist in placing it, it is worth while doing so, even to the extent of obtaining tenders, and by other means taking as much of the work as possible off the prospective consumer's hands.

A flexible tariff of charges is of the greatest assistance in obtaining power or large supply business. While the ordinary installation must, for several obvious reasons, be charged at the regulation rate, exceptionally large supplies may with equity and without showing undue preference, be quoted for at special figures. The fact that a man has succeeded in obtaining a lower offer than that open to his neighbours goes a long way towards clinching the bargain; and when that offer can be justified, as is usually the case where a very large supply is in question, it should certainly be made. Much valuable work has been lost to supply authorities by a rigid tariff and refusal to make a perfectly warrantable reduction. The "restricted-hour" system for factory supply is an excellent one where it is practicable, and it should always be in the power of the representative to make such a suggestion. The larger the factory, the more it will appeal to the management, which, if at all progressive, may agree to alter their hours or routine of working if thereby they can materially reduce their power cost.

An important detail in power canvassing, which should not be neglected, is the acquisition, as far as possible, of a good knowledge of every private generating plant or engine installation in the district. It is by no means an easy matter, as people naturally resent what they will deem impertinent prying into their affairs, but, by dint of patience and tact, it can be done, and when accomplished, will be found of great value. In all but most exceptional cases, every power user and private plant owner is a potential consumer, sure, sooner or later, to come on to the public supply. One cannot tell at what time some fortuitous circumstance may cause him to look upon it more favourably, and hence it is well to be ready with carefully prepared plans and figures based upon as complete a knowledge as possible of his plant and conditions of running. In any efficient development scheme we can assume that every potential consumer of this class will have been interviewed before long, and although in many instances the result may have been unsatisfactory, a man well up in his work, and scheming to that end, will have managed to elicit much useful data. He cannot find out too much; the hours of working, the cost of fuel, the number of lamps or machines together with the approximate horse-power the latter require, wages and cost of repairs are all essential, and numerous other details will suggest themselves as each case is thought out. It is particularly desirable to ascertain if there has ever been any legal trouble over noise, vibration or smell, and also whether the plant has ever broken down, and with what results.

Let the representative start out with a clear idea of what he wants to know, supplementing the interview if unsatisfactory with judicious inquiries in every likely direction.

Whatever knowledge he gathers should at once be reported in writing, analysed, clearly recorded, and filed away for future reference. If the data is sufficient it is desirable to plan out a scheme of conversion, giving full details, a reason for everything at all out of the way, and an estimate of capital and revenue cost. When the inevitable breakdown or other "fortuitous circumstance" comes along, the record, if it has been kept up-to-date, will enable a well thought-out scheme to be put forward with the least possible delay, and prompt action being everything in these matters it may well turn the scale. Records of this nature will frequently become obsolete in a short time if not continually revised; it is therefore essential to keep as far as possible in the running with all important alterations. In a large power area the scheme would be too costly and unwieldy to carry out thoroughly, and one must be contented with something of a less inclusive nature. The ordinary district, however, presents no great difficulty if the canvassing operations are carried out on proper systematic lines.

In obtaining power business the value of example is considerable, so much so as to make it well worth while to collect and tabulate particulars of the various installations where generating plants and engines have been taken out. Photographs before and after conversion, taken in such a manner as specially to bring out the features put forward as constituting the advantages of electric driving, will be found useful. Short of viewing the actual plant there is no better method of bringing home many of the economic features. Local testimonials also will be found of service, and in some form or another a list should be issued giving the names, addresses, and trades of consumers who have scrapped their own plant together with their reason for doing so. Sample accounts are very useful, particularly if a wide selection of them covering many trades and conditions of working is available. This weapon must, however, be used with discretion as consumers will not thank the supply undertaking for thus making public their private affairs.

REVIEWS.

The Internal Lubrication of Steam Engines. By T. C. Thomsen. London: Technical Publishing Co., Ltd. Price 2s. 6d. net.

The subject of engine lubrication is one which has not received the degree of attention which it merits at the hands of technical writers, and the practical treatise on the internal lubrication of steam engines from the pen of Mr. T. C. Thomsen will prove of interest and value to all who are seeking after the production of power at low cost, and who are endeavouring to effect economies wherever possible in the power house.

That it is possible to save money by improved methods of lubrication and the use of high grade lubricants is shown by the fact that in many plants, which were supposed to be operated at the lowest possible costs, the total expenditure of power has been considerably reduced by adopting suggestions based on lengthy practical experience with high-class lubricating oils. It has been held by some engineers that lubrication for steam engines of the vertical type is not really necessary, but practical tests have proved that to discontinue lubrication means increased expenditure of power and increased consumption of steam through leakage past valves and pistons. Every engineer is aware that where the internal surfaces of cylinder and piston, or valve and valve-seat are well worn together, and a good skin produced, it is possible, with wet steam, to run for long periods without lubrication, but in the electrical power house the conditions are generally such that lubrication is not only advisable, but necessary. The author cites an instance where a 900-H.P. compound engine driving a generator supplying energy for traction purposes, was well lubricated with high-class oil, and indicator diagrams taken which showed that, to overcome the friction of the engine and generator, and give an output of 840 amperes at 500 volts, 751 H.P. had to be developed. When the experiment was tried of running the same engine without lubrication for 3½ hours it was found that 786 H.P. were required to give the same electrical output; as soon as lubrication was again resorted to the power required fell immediately to the original figure of 751 H.P.

Many similarly convincing illustrations are contained in the book, and the subject of lubricators and lubricating is exhaustively dealt with. One of the chapters which deserves special notice deals with the lubrication of engines employing superheated steam, and many examples of cylinder troubles and their remedies are given. The chemical and physical properties of cylinder oils are discussed in a preliminary chapter, and the direct and indirect methods of cylinder lubrication are dealt with, as also are the merits of practically every form of cylinder lubricator. The dangers due to the presence of cylinder oil in boiler-feed water, and the means of overcoming them for the various types of engine are also treated at some length, whilst exhaust steam oil separators and feed water purifiers come in for considerable attention.

The book is well written, and every page betrays the intimate knowledge the author has of his subject. Mr. Thomsen states that he has written it in the hope that it may prove of assistance to engineers directly interested in the satisfactory running of steam plants; and, from a careful perusal of its pages, we may express ourselves as confident that it will meet with the success it undoubtedly deserves.

Water Turbine Plant: A Short Practical Treatise. By Jans Orten-Böving. London: Rathby, Lawrence and Co., Ltd. Price not stated.

This book has purposely been prepared, partly as a text-book and partly as a catalogue. It is certainly a remarkable compilation. Perhaps we shall be most fair to the author if we call it a scientific catalogue, although that title hardly expresses with clearness the really beautiful compilation before us. It is not a price list. It is divided into three parts, the first of which deals with theory and tests, the second with classification and dimensions, and the third gives descriptions of numerous power stations.

The available sources of information in regard to water-power in this country—as the publishers remind us in their circular—are very limited. Apparently they are more fortunate in that respect in Germany. For the last five years Mr. Orten-Böving has practised as a "water specialist"—we suppose that means a hydraulic consulting engineer—in London. The basis of the volume is a series of lectures which Mr. Böving delivered before the Japanese Association of Mechanical Engineers.

The book is splendidly produced. There are 218 illustrations, many of them being very clear and well-arranged line drawings. There is a great deal of really useful practical information, such as is most valuable to the student and the hydraulic engineer, but which has certainly never yet been included in any British text-book on hydraulics. The section devoted to automatic governors is excellent. At every opportunity a numerical example is included. The plans and sections of machinery, power stations, &c., are very clear, and the reports of the tests of turbines, and the graphical method of representing results, are capital. It is very seldom that the student obtains any idea of the dimensions of machinery, and for that reason the numerous dimension tables are most useful. Space will not permit of further description of this really excellent work. It contains just over 200 pages on art paper, the size of the book being 11½ in. × 9 in. The contents are as interesting as they are useful.

Power and its Transmission: A Practical Handbook for the Factory and Works Manager. By T. A. Smith. London: E. & F. N. Spon, Ltd. Price 2s. net.

The first sentence—in the preface—of this book is somewhat alarming. We quote it for the reader to judge the author's style. It is as follows:—"This is a very wide subject, with many intricacies, which could not be fully noted herein, the object of this handbook being to provide the works manager with a general knowledge of the requirements of his plant, and point out how efficiency in running may be attained, rather than the construction or care of machinery generally, which is not within its province; though to further its utility as a workshop companion, some remarks on the gas engine, dynamos and motors, oils, &c., are presented." Now the man who understands what that sentence means, and who can "provide the works manager with a general knowledge of the requirements of his plant" by means of a book of 71 quite small pages, is a genius. After reading a few pages of the book now before us, the engineer will probably lose patience. A complete perusal is a trial, but it gives one an idea which is perhaps an excuse for the appearance of the book. The author knows a good many odd practical "tips" about belts, shafting and pulleys. He cannot express himself in a very intelligible fashion, and he seems to have written bits of notes at odd moments and strung them together in a haphazard and careless fashion. To call such notes by the title of "Power and its Transmission" is either a joke or effrontery; to devote four pages to the gas engine, of which two and a quarter pages deal with *tube* ignition—electrical ignition is not even mentioned in the chapter!—is absurd. We must quote another sentence—a gem—which opens the section on ignition:—"Due mainly to the peculiar behaviour of iron ignition tubes under heat and internal pressure, it is always advisable to look to them first of all when the engine shows signs of missing fire, and to always examine the bore of a fresh one, and ascertain that it is perfectly clear before putting it on." You cannot expect much for two shillings, but the most attractively written pages of this book are the advertisements of bearings, packings, &c. The definition of a horse-power in the preface reveals another touch of (unconscious?) humour.

Applied Mechanics. By Prof. Andrew Jamieson, M.Inst.C.E. Vol. 5. Theory of Machines and Practical Mechanisms. Seventh edition, revised and enlarged. London: Charles Griffin & Co., Ltd. Price 7s. 6d.

We have already reviewed the other four volumes of this book on Applied Mechanics, and it may be remembered that we somewhat anxiously anticipated the appearance of this volume. We may say at once that we think it quite good. The different lectures are so arranged as to cover the final B.Sc. examination in engineering for external students, as printed in the regulations of the University of London. They also cover several other examination courses. Of all the subjects which the engineering student has to tackle, and of all the sub-divisions of engineering theory which puzzle the learner, the theory of machines is probably the most difficult to understand. It is, to the beginner, so intangible. It is sometimes very badly taught. It is only interesting to those who know it in an advanced manner, and those *savants* usually cannot write for the beginner. In the 18 lectures which make up this volume, the difficulty has been overcome. The first five chapters are on kinematics; then we have mechanisms, efficiency and gearings. There are four lectures on wheel gearing, and we cordially approve of the details included.

Two lectures are given on belt and rope gearing, after which there follow two chapters on inertia. There is a big folding plate showing the crank-effort diagram for a five-crank engine, and the size of the diagram enables the student to have the advantage of a large scale. The remarks on governors are quite clear.

A commendable feature of the book is the large number of examination questions, to which the answers are given. Another feature, first introduced, we believe, in books of this class by Prof. Perry, is the use of two types, so that the elementary student is immediately warned when he comes to advanced work. In some of the lectures the figures are numbered, in others they are not, which seems rather a pity. At the end of the exercises space is left for notes, which is probably a wise arrangement. The diagrams are better than in the other volumes. While we think that this book reflects credit on the author, yet many of the remarks which were made about the first four volumes apply also to this one. The price is too high for the average student. That is probably a matter in which the publisher is chiefly concerned, but the author might have assisted by omitting some of the plates and photographs. You may have a good article, but nowadays even the student expects a lot for his money, and between them the author and publisher must give him the contents of this book at a lower price—otherwise some other author and publisher will do so.

The Theory of Ionisation of Gases by Collision. By John S. Townsend, F.R.S. London: Constable & Co. Price 3s. 6d. net.

In the space of four chapters and 82 pages, Prof. Townsend deals with ionisation by negative and positive ions, sparking potentials in a uniform electric field, and the theory of electric discharges in non-uniform fields of force.

While it is well known nowadays that "ionisation" of gases generally occurs when they are acted upon by "X"-rays, radium, or ultra-violet light, the actual mechanism involved is generally less clearly understood.

According to the "collision" theory of generation of ions, if ultra-violet light strikes a zinc plate, a number of negative ions are liberated, which, if acted upon by a field of force, can be propelled to a positive plate. Now, if a number N were liberated, and no new ions were generated, the current (which depends on the number of ions) would, therefore, be completely independent of the distance between the plates for a given potential gradient.

It appears, however, that for certain distances the ions liberated collide with molecules in the gas, knocking off other ions from them, and these ions liberated from the molecules knock others off; hence as the distance between the plates increases the current increases. The number of ions generated increases in a geometric ratio with distance, so that the logarithmic method of calculating is applicable.

All the old theories of surface layers, &c., failed to explain these facts. The peculiar bend in the curve showing the relation between the current and the P.D. after the saturation value is passed is thus accounted for by the generation of ions by collision.

Apparently it is as difficult to extract an ion from a molecule of gas as it is to extract it from the zinc plate. Their properties appear also to be the same in such cases. In order to generate ions by collision a velocity of $2{\cdot}7 \times 10^8$ cm. per second is necessary, and it is remarkable that 20 to 40 volts is sufficient for this purpose. It is shown also that the ionising powers of positive and negative are in the ratio of 1 to 57 for air, whereas in carbon dioxide the ratio is 1 to 1,070. This supports the idea that positive ions are of the same dimensions as molecules.

To electrical engineers the observations of sparking potentials are interesting, and it is shown that the potential required to maintain a discharge is much less than the sparking potential. From the collision theory the sparking potential for a given distance can be calculated, and appears to be in practically perfect agreement with potentials experimentally observed.

It is also not generally known that it is impossible to obtain a spark in air at atmospheric pressure over a distance which is only a fraction of a wave length of sodium light until 360 volts are applied.

Prof. Townsend has written this little book because "the text-books do not contain a good description of the methods by which the fundamental principles are established . . . ." After the student has read this book, he will conclude that Prof. Townsend's account of this difficult subject is remarkably clear and convincing.

The book must be of great interest to all students of modern physics.

THE DESIGN OF MINING SWITCHGEAR.

By G. M. HARVEY, B.Eng.

The rapid increase during recent years in the number of collieries equipped with electrical plant underground, and the consequent increased demand for plant of a special nature to suit mining conditions, has resulted in there being now upon the market a very large variety of so-called "mining" switches, motor-starters, &c., and in passing these in review one cannot help thinking that their designers have in some cases very little idea of the actual conditions under which the results of their labours will be called upon to operate.

In the first place, "mining" switchgear must of necessity mean switchgear suitable for use in mines, or parts of mines, which are "fiery," that is, in which General Rule No. 8 of the C.M.R.A. applies, and in such mines, it is almost universally acknowledged that nothing is really safe but switchgear breaking under oil. This practically disposes of D.C. plant for such mines or situations, and the following remarks apply to A.C. switchgear only.

Designers of switches for use in mines must bear in mind that such gear will be in the hands of a different class of operator, to that in control of what might be termed "drawing room switchgear," an operator whose sole objects in life are (1) to get coal; and (2) to save himself trouble. Consequently, if he can so overload his haulage motor as to obtain more coal per diem, without tripping the switch, he will do so. The writer has seen "mining" switches fitted with no-volt and overload releases, which are easily rendered inoperative by the mere insertion of a piece of wood, say a broken pick-handle, and no amount of inspection or explanation will ever entirely remove this danger. Switches must therefore be designed to be "double-fool-proof," that is, so arranged that no man, unless provided with tools or a special key, can, even deliberately, obtain a shock from them. If not, the switches should be locked up in a switch room and only operated by the electrician in charge of the district.

The following points in design should receive particular attention:—

A large number of switches are provided with sweating sockets for the reception of the incoming and outgoing cables, regardless of the fact that a soldering iron is probably out of the question in the position in which the switch is to work. Mechanical terminals of a substantial nature are inexpensive, and should always be fitted; they should have ample contact area for their normal load at a low density, be provided with at least two screws for clamping the cable, and be so placed in the switchbox that the cable can easily be inserted or removed without dismantling the switch.

The immersion of the switch contacts in oil removes the necessity for a flame-tight case, but the case must still be strong enough to prevent damage through accident or careless handling, and should be, as far as possible, dust proof. All joints in the case should be faced metal-to-metal, no packing being used.

Fuses in air are out of the question, and in oil they are unreliable—in the larger sizes at any rate. They should be eliminated entirely, overload or no-volt releases, or both, being provided to suit the conditions. The trip coils should be oil immersed, as also the resistances in series with the no-volt release coil, if these resistances cannot be dispensed with altogether. Trigger gear, for the purpose of cutting out the trip coils in starting up, is inadvisable, as it may be used, not only at starting, but irregularly as mentioned above. Where it is advisable to cut the trip gear out at starting, this should be done automatically in the starting switch.

Ready accessibility of all parts is a most important feature, and the removal of the oil tank for inspection of the parts usually immersed, should be a one-man job. Many makers seem to have the idea that the smaller the switch the better; it is better, however, to sacrifice a little wall or floor space, than to install a switch, the parts of which are so cramped and intermixed that, in order to find or repair a fault, or to set the trip gear, it is necessary to take the switch to the surface. The oil tank should be clearly marked with the correct level of the oil, when removed from the switch, and this level should be set to allow a head of oil over the switch contacts when in use, of at least 1½ in., to provide for a possible tilting of the switch due to movement of the floor or wall to which it is fixed. No screws must pass through the oil tank below the oil level, and all holes for cables entering the switch case should be set well above this level, to prevent splashing or creeping.

If a trifurcating box for the incoming cable can be cheaply included in the switch case, so much the better. It is not necessary that such a box should be arranged to be filled with compound, provided that the cables are so supported inside the box as to guard against their coming in contact with any metal. In any case, it is essential that all holes through which unarmoured cables pass, whether these cables are three-core or single, should be bushed with insulating material, the edges of the bushes being rounded to prevent damage to the dielectric. For armoured cables this bushing is, of course, unnecessary, but an armour clamp must then be provided to secure continuity of the earthing.

In the case of star-delta or auto-transformer starting switches, the knife switch type is preferable to the drum type, as doing away with the gearing necessary with the latter, if the drum is horizontal; the contacts of a drum type starter are also very liable to give trouble, and require frequent renewal. If sparking tips are provided, these should be readily renewable.

The switch handle should be of malleable iron or steel, of ample strength to withstand the roughest usage, and should have good electrical contact with the body of the case.

The handle of a starter fitted with an overload release must be "free," so that the starter cannot be held on against an overload.

An earthing terminal must be fitted in an accessible position on the outside of the switch case, and it should be capable of taking a 7/18 cable.

In the case of switches enclosed in a sheet-iron unit-type panel, the details of the mechanism naturally do not require the same protection as in the case of a separate switch, and for this reason particular care should be taken in guarding against the one remaining source of danger—an accumulation of dust, causing a leakage to earth. These switch panels, particularly when used as feeder panels to a district, cannot be inspected and cleaned very frequently, and should be made as dust-proof as possible.

To sum up, the order of virtues of a mining switch should be as follows :—

1. *Safety.*—The collier is an inquisitive bird, and will get a shock if he can.

2. *Reliability.*—The breakdown of one switch may mean the loss of many tons of coal per day. This annoys the collier—and others. Remember that the collier is accustomed to nothing more delicate than a pick and a sledge-hammer.

3. *Economy.*—This does not hurt the collier, and it pleases the others.

With the enclosed incandescent lamp fitting as near perfection as it is to-day, it is strange that the manufacturer has not turned his attention to providing a more satisfactory lighting switch of small capacity, than is at present obtainable—something which will take the place underground of the tumbler switch and fuse. The iron-cased "gas-tight" switches in use are most unsatisfactory, some of them being actually unsafe, and engineers are compelled either to adopt a switch of a capacity out of all proportion to the load, or to make up something themselves.

What is wanted is a double-pole, oil-immersed quick-break switch with oil-immersed fuses, or better still, a switch-fuse, of about 5 to 10 amperes capacity, the fuses, if separate from the switch, being of the porcelain-bridge type. Tumbler switches can be used, and would cheapen the article. The switch and fuses should be in the same tank, with a division between them, enabling the fuses to be replaced without the danger of touching the live terminals of the switch. This should make up into a handy and compact little switch, and would enable electric lighting to be introduced into almost every part of a fiery mine with all reasonable safety.

A NEW METHOD OF RECORDING AND REPRODUCING SOUND WAVES.

A number of methods of recording sound vibrations are in use, including the Edison phonograph method, which depends on minute depth differences produced in the surface of the recording cylinder, the Berliner method in which a wavy line travelling round a spiral forms the record, the smoked surface record, &c. A different method has been recently suggested by Herr B. Gwozdz. In this method the record is made in the form of a graphite or lead pencil line of varying thickness (and, therefore, varying electrical resistance), formed under the control of the sound vibrations on a strip of insulating paper.

The reproduction of the sounds is effected by introducing successive small portions of the pencil line into an electric circuit containing a telephone receiver, the current through which is, consequently, varied according to the thickness of line or the loudness of the corresponding tone. No practical test results are at present available, but one method of carrying out the suggested plan is indicated in fig. 1. In place of a simple pencil line, the recording line is here made by varying the pressure with which the paper strip *a* is pressed against the graphite roller *i* by the point *g*. The paper strip is drawn over the graphite roller by means of the friction rollers *b* ; *c* is a membrane fitted to the funnel *d*, into which the sounds are made. This membrane moves the lever *f* about the centre *e*, and so varies the pressure of the point *g* against the paper.

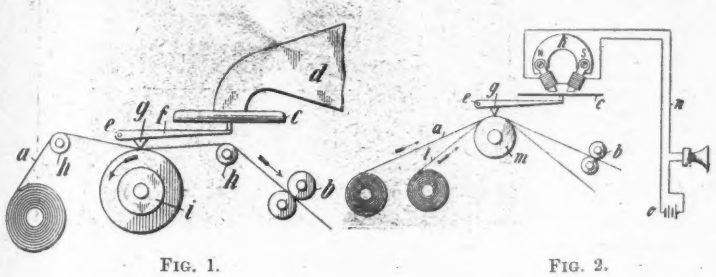


Fig. 1.

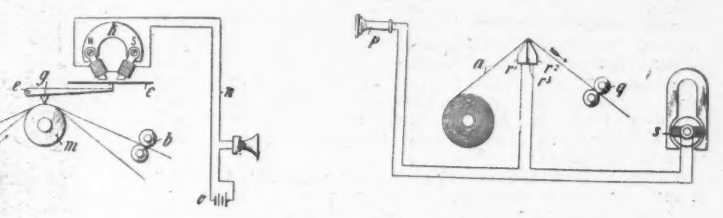


Fig. 2.

Fig. 3.

Recording and Reproducing Sound Waves.

In place of the graphite roller, of course, an actual pencil point might be used or a carbon sheet, such as is employed in the typewriter.

The membrane also need not be influenced directly by the sounds. It can be arranged—as in fig. 2, for instance—to be vibrated by means of an electromagnet *k* actuated by the currents passing in the battery and microphone circuit *n*. In this diagram, the graphite roller is shown replaced by a metal roller and a strip of carbon paper *l*.

Fig. 3 shows one form of the reproducing apparatus. A circuit is formed leading from some current source δ to a telephone receiver *p* and to the two metal prisms r_1, r_2, which are separated by the thin insulation strip r_3. The paper strip *a*, with the graphite record on it, is run, face downwards, over the point of the prisms, as shown, thus closing the circuit at each instant by means of a short piece of the record line and allowing a current to pass through the telephone depending on the thickness of the record line at that spot.—*Der Mechaniker*, No. 6.

DOCK PUMPING AT BROOKLYN.

The Erie Basin Dry Docks at Brooklyn, N.Y., is the largest ship repairing and docking establishment in the States ; it covers an area of 23 acres, and comprises two dry and three floating docks with the necessary repairing shops.

Recently, according to the *Electrical World*, which quotes a paper before the Brooklyn Engineers' Club, the prospect of considerable additions to the power required in the yard, and the fact of the existing steam plant being composed of many scattered and inefficient units, led the firm to study the question of electric driving, and ultimately to come to terms with the Edison Electric Co., of Brooklyn, for a supply of energy.

The Edison supply is three-phase at 6,600 volts and 25 cycles, to a main sub-station with a 13-panel switchboard ; two panels handle the company's supply, and the remainder control distributing circuits to H.T. motors for compressing air and pumping, and to local sub-stations, &c.

Naturally, the dock plant is the most interesting ; it was the addition of a new 6,000-ton pontoon floating dry dock which led to the use of electric power. This dock is 335 ft. long and 100 ft. wide, and will take vessels of about 400 ft. in length. It is composed of ten separate floating pontoons mechanically joined by the side walls ; each pontoon is provided with a 12-in. centrifugal pump on either side of the dock, and each set of ten pumps on either side, is operated by a 300-H.P. motor through a horizontal line shaft with bevel gears, and vertical shafts running down to the pumps in the bottom of the dock. The motors are controlled from a transformer sub-station on the pier ; speed variation is obtained in the usual way by inserting resistance in the armature circuit by means of slip-rings, the secondary circuit being connected through flexible cables to the sub-station.

The dock can be pumped out in from 25 to 35 minutes.

The second dock to be fitted was a 4,000-ton balanced floating dry dock ; this is an old dock, but the 12 single-acting bucket pumps. (36 in . diameter × 30 in. stroke) were of ample capacity, and were retained and driven by four 100-H.P. 450-volt motors, each motor driving three pumps. The controllers were placed on the dock and are of the drum type.

The next application of electricity was to a new air-compressing plant, which replaced the existing steam-driven compressors. Two new Ingersoll compressors were put in, each coupled direct to a 360-H.P. 6,600-volt motor, and have a combined output of 4,000 cb. ft. of air per min.

The two graving docks are served by a common set of pumps, which replaced old plant, and in order not to interfere with the use of the docks, were housed in a new building. The pumps, which draw from a well into which the docks drain, are fixed in the upper

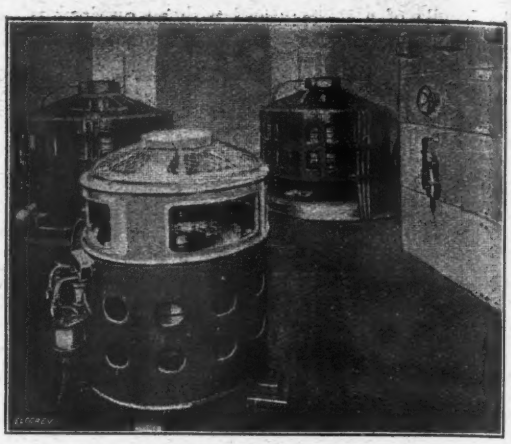
part of the well below low-water level, and consist of two 30-in. vertical-spindle centrifugal pumps, coupled direct through shafting to 350-H.P. 6,600-volt motors in a special motor room above. A 12-in. drainage pump of similar pattern is installed for drainage only, being driven by a 50-H.P. 440-volt motor.

The armature and vertical shaft of these motors are carried on ball bearings at the upper end of the shaft, and flexible couplings are introduced just above the pumps, which are provided with independent water-cooled thrust bearings. In the latter bearings, the weight is carried on a floating bronze ring fitted with lignum vitæ pins, this method of construction being found satisfactory in working.

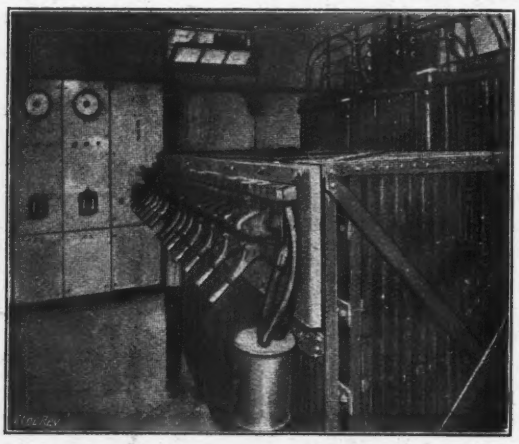
For controlling the working of the large motors, oil switches are used and multiple switch starters provided with resistance for starting only and interlocked, so that the main switch cannot be closed unless all the resistance is in the armature circuit. Any desired control of the pumps is obtained by closing the delivery gate valve of the pumps. Some two hours are required to pump out the larger dock, approximately 7,500,000 gallons of water having to be removed.

Another 6,000-ton sectional dry dock of considerable age is being equipped for electric pumping, the equipment is to consist of 20 20-H.P. motors and two 50-H.P. motors. The 20-H.P. motors are each to be direct-coupled to a centrifugal pump, and the 50-H.P. motors will be used for controlling the ballast tanks. A special controller system will be supplied, allowing a group of 10 motors to be started, stopped or the speed varied uniformly from a master controller.

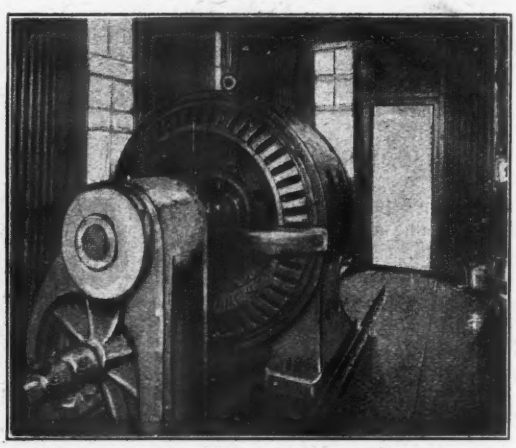
Direct current is used for lighting purposes, but the shop motors are of the 440-volt three-phase constant-speed type, fed through banks of single-phase transformers, and are fixed either on ceilings or on special overhead platforms. There is now installed and in operation 2,774 H.P. of motors. The total energy consumption for the month of May, 1910, was 263,200 KW.-hours, and it is interesting in an installation of this kind to learn from the watt-hour meters on the main switchboard the distribution of this energy.



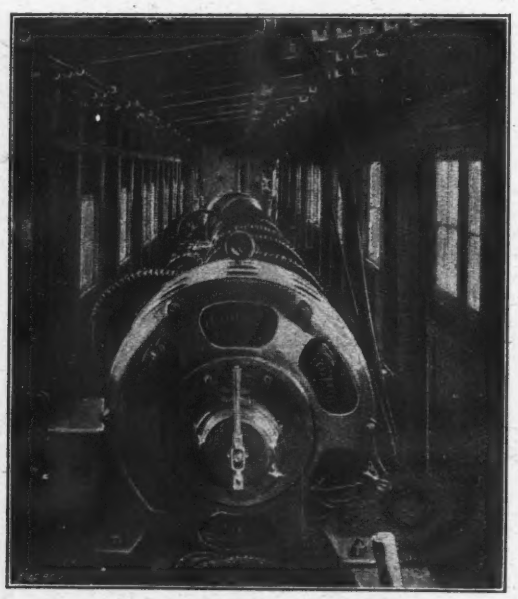
Pump Motors for Graving Docks.



Control Switchgear for Pontoon Dock.



300-H.P. Pump Motor on Pontoon Dock.



Induction Motors and Gearing, Balanced Floating Dock.

The list is headed by the air compressors, which have a combined consumption of 67·1 per cent. of all the energy used. Transformer station No. 1 supplied energy for the lighting dynamos and machine-shop motors, and shows a consumption of 9·58 per cent. The two large graving-dock motors come next with a consumption of 9·42 per cent., followed by the small graving-dock drainage motor with 7·36 per cent. Transformer station No. 2, supplying the boiler shop, copper shop and blacksmith shop motors, takes 3·54 per cent. of the energy. The new dock, with two 300-H.P. motors, consumes only 1·56 per cent., and the balance dock, with four 100-H.P. motors, 1·44 per cent.

The 50-H.P. motor running nearly constantly on the graving docks consumes almost as much energy as the two 350-H.P. motors used in pumping these docks. The new 6,000-ton pontoon dock has a capacity almost as large as one of the graving docks, and handles more vessels than either, but requires less than one-fifth of the energy to operate it. While there is a total installation of 2,774 H.P., it has been found practicable to work with a maximum demand of 1,200 KW., a figure which was arrived at at the time the contract for service was arranged, it being understood, of course, that maximum demand influences the cost of energy. It is practically certain that if the works were operating from a private electric generating plant the installation would have to be very much greater, in all probability not less than 2,500 KW., to allow for spare boilers and generators, and the unwillingness of the different departments to handle the work so as to keep down the maximum load.

By the terms of the present contract any amount of power is available to meet a necessity, but it is distinctly understood that a study of the distribution of the work will mean a saving, and directly affect the earnings of the company.

A daily record of the watt-hour meter readings is kept and checked with the monthly bills from the central station meters. The positive knowledge of the cost of energy and its distribution is of very great value to the accounting department of the business.

South African Plant.—It is proposed to expend some £20,000 on electrically-driven plant to work the alluvial tin deposits at Groenfontein, Transvaal.—*African Engineering*

ELECTRIC LIGHTING IN SMALL HOUSES.

We have received from Mr. H. W. Angus, Borough Electrical Engineer, some particulars regarding the experimental electric lighting of workmen's dwelling houses recently carried out by the Eccles Corporation.

As the above class of property greatly predominates in the Borough of Eccles, it presents a wide field of business, provided it can be catered for on reasonable terms. The object of the experiment, which has been carried out during the past 12 months, was to ascertain whether the supply of electrical energy for such a purpose could be given on profitable terms by the Corporation and, at the same time, at a cost to the user that would encourage the general use of electric lighting in this class of property. Previous results obtained in Eccles when supplying this class of house, with eight metal-filament lamps installed, has shown that the income for the electric energy consumed when charged for at the Corporation's standard price per B.T.U. approximately amounts to 26s. per house per annum. With so small an annual income, it is, of course, evident that such business would not prove remunerative to the Corporation should they have to incur the expense of a separate meter and service for each house and also low-tension distributing mains. If, however, the landlords of such property would install in rows of similar houses electric light wiring, fittings and distributing mains, and obtain from the Corporation at their standard rate of charge a bulk supply of electrical energy, it is possible that the cost of the electrical energy consumed by the normal use of the electric light would be covered by a charge of 6d. per week on each of the tenants.

An opportunity to ascertain whether such is the case presented itself when the Eccles Corporation Health Committee were erecting a block of 12 workmen's cottages.

It was suggested to the Health Committee that they should install electric light wiring, fittings, and low-tension distributing main in this property, and the Electricity Committee offered to supply to the Health Committee, through one service and meter, the electrical energy required by the 12 houses at such a price per unit as would enable them, without loss to themselves, to charge each of their tenants at the rate of 6d. per week for the use of the supply, subject to the following conditions:—

1. The charge for electric light provides for the normal use of same. When rooms are not being used the electric light must be switched off, and no lamps are to be left burning after tenants have retired to bed at night, or during the hours of daylight. If the above conditions are found to be infringed, an extra charge will be made for the excess consumption of electrical energy. It is to be remembered that the more the lamps are burned the sooner they will give out and require renewing.

2. When any lamp requires to be renewed, a written order is to be sent to the Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft, and the lamp will be supplied and fixed at the following prices: 32 C.P., 2s. 9d. each; 16 C.P., 2s. 6d. each; 12 C.P., 2s. 6d. each. Amounts due for lamps supplied must be paid to the Borough Collector by the following Monday. The renewal of lamps will only be carried out between the hours of 9 a.m. to 5 p.m. on Monday to Friday inclusive, and on Saturday 9 a.m. to 12 noon.

3. No other lamps but those supplied by the Borough Electrical Engineer are to be used.

4. Tenants must not remove any lamp and use it in another room, or replace a lamp with one of their own.

5. Tenants must not interfere with, remove, or replace, any fittings without written permission to do so from the Borough Electrical Engineer.

6. Infringement of Conditions 3, 4 and 5 may render the tenant liable to prosecution.

7. Officials of the Corporation Electricity Department are to be entitled at all reasonable times to enter the houses for the purpose of inspecting the fittings, lamps, wiring, &c.

This suggestion was accepted, and the following is the general arrangement of wiring and fittings that was installed in the houses:—

The Electricity Committee's service cable was taken into one of the houses in the middle of the row, and the meter, main fuses, &c., fixed at this point. The remaining work inside the property was carried out by the Health Committee, and consisted of installing an auto-transformer reducing the pressure of the supply from 200 volts to 50 volts, from the terminals of which a distributing main was run through the cock lofts of the houses, and from this distributing main services were run to the various houses. The wiring in the houses was run throughout in wood casing, and every lamp was provided with a separate switch fixed on the wall. A paper seal was fixed to each lampholder and lamp, so that no lamp could be removed without detection.

The following is a schedule of the lights installed in each house:—

Ground floor.—Entrance hall, one 12-C.P. 13-watt lamp; parlour, one 32-C.P. 35-watt lamp; kitchen, one 32-C.P. 35-watt lamp; scullery, one 12-C.P. 13-watt lamp.

First floor.—Bedroom No. 1, one 16-C.P. 17-watt lamp; bedroom No. 2, one 12-C.P. 13-watt lamp; bedroom No. 3, one 12-C.P. 13-watt lamp; bath room, one 12-C.P. 13-watt lamp.

The total cost to the Health Committee of the above wiring, fittings, lamps, and auto-transformer, amounted to £61 10s.

The metered consumption for the first 12 months' supply to the above houses (all houses being tenanted throughout the period) amounted to 1,205 Board of Trade units, and in this figure is included the core loss of the auto-transformer, which is permanently in circuit.

The Health Committee have been debited with the above consumption at an average price of 3·106d. per Board of Trade unit, which has enabled them to charge without loss each of their tenants 6d. per week for the use of the supply. The Electricity Committee's standard rates of charge for a supply for general lighting purposes are at the flat rate of 4d. per Board of Trade unit, or alternatively on the maximum demand system of 7d. (first hour) and 2d.

If the above supply had been charged on the maximum demand system, it would have worked out as follows:—Total metered consumption for the 12 months = 1,205 B.T.U.; maximum rate of demand, 740 watts. Therefore, 270 units would have been charged for at 7d., and 935 at 2d., which is equivalent to an average price of 3·12d. per B.T.U.

With reference to the cost of lamp renewals, which has to be borne by the tenants, this has not been a serious expense, as only nine new lamps were required in the above 12 houses during the 12 months.

The result of this experimental lighting has undoubtedly shown that under the above conditions the cost of electric lighting in workmen's dwelling houses need not be an obstacle to its general adoption.

Any landlord may obtain a similar supply from the Corporation on the maximum demand system of charging, which will enable him, under like conditions to the above, to offer his tenants similar terms to those offered by the Health Committee to their tenants.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SERVIA.

In order that British goods may enjoy the benefit of the treaty rates of Customs duty (*i.e.*, the rates quoted below), certificates proving their British origin should be produced. Such certificates may be issued by Chambers of Commerce or Industry of the country from which the goods come; police and municipal authorities of the place from which the goods come, if in such places there exists no Chamber of Commerce or Industry; the export Customs houses of the country in which the goods originate; Servian Legations, Consulates-General and Consulates, with the exception of honorary posts. Certificates of origin may differ in form and wording, but they must in every case contain a register number, the marks and numbers of the packages, the gross and net weight, the denomination of the goods, and the name of the sender. After giving the above, it must be certified that the goods are the produce of the country in question. Invoices or declarations made by the seller, of which the competent authorities only certify the seal and signature, and not the origin of the goods as well, will not be accepted as proofs of origin.

Certificates of origin must agree with the bill of lading issued in the country from which the goods originate or were forwarded. If they do not agree, and in any case where the goods do not arrive with a through bill of lading issued by the exporting country, *i.e.*, the country of their origin, the certificates will only be accepted as sufficient proofs of origin if the country from which, according to the bill of lading, the goods were forwarded, is a State entitled to the treaty rates of duty. If, on the contrary, the country from which the goods arrive is, according to the bill of lading, a non-Treaty State, the minimum rates of duty will be levied only in cases where, besides the certificate of origin issued by the competent authorities of the country from which the goods were originally forwarded, the goods are accompanied by the bill of lading (either the original or a certified copy or extract) with which they were forwarded from the country which, in the certificate, is given as the country of origin of the goods. Certificates which only certify that the goods were forwarded from the transit store-houses, or simply from the store-houses, depôts or ports of some State entitled to the treaty rates of duty, will not be accepted as certificates of the origin of the goods. For goods which by their nature are obviously of foreign origin, certificates issued by the competent authorities of the country to which the store-houses, &c., belong, must be produced, and these certificates must, besides the requisite particulars as to the goods, also give the country of origin. In addition to such certificates, a certified copy or extract of the through bill of lading with which the goods arrived at the store-houses, depôts and ports must also be produced. Postal invoices not accompanied by Customs declarations, or *vice versâ*, will not be accepted as sufficient proofs of origin. If it happens that an importer of goods cannot immediately produce a certificate of origin, either because it was not sent with the goods, or having been sent, has got lost, or because the certificate is not in accordance with the regulations, the Customs must apply the maximum tariff if the importer wishes to withdraw the goods at once, and does not desire to let them lie at the Customs house during the period provided for by law. In such cases a time limit for the production of the certificate will be accorded to the importer to whom the difference between the maximum and minimum tariff duty will be returned, if he produces the certificate within the prescribed time limit. The maximum time limit in the case of goods from European countries is fixed at 30 days, and for goods from all other parts of the world at 60 to 90 days. Certificates of origin in the

case of goods which for any reason are exempt from the payment of Customs duty and "trosharina," are for the present not required.

Invoices and consignment notes should state the gross weight of the packages and the net weight of contents, which should be fully described. The country of origin should also be stated. When various descriptions of merchandise are packed together, the net weight of each class should be stated separately. The following duties are payable :—

25 dinars = £1. Kilog. = 2·204 lb.

	Dinars per 100 kg.
Tinder fuses, igniting strips for miners' lamps, and for lighting...	40
Caoutchouc and gutta-percha strips, also tissues saturated or covered with caoutchouc or gutta-percha with linings or layers of caoutchouc and gutta-percha, or with layers of tissues even combined with common metals or their alloys	120
Tubes of hard caoutchouc	120
Mica : In slabs up to 20 cm. thickness	1·50
In slabs further prepared	3
Heat insulating material of asbestos infusorial earth or mixtures thereof	3
Articles of asbestos :	
Paper and cardboard polished, cut, pierced, also with inserted wire...	18
Spun wares made of asbestos, also braid, string, cord, even combined with other textile materials or wire	18
Tissues made of asbestos, even combined with other textile materials or having the weft or warp of wire of common metals	24
Other articles of asbestos, asbestos paper or asbestos tissue, gloves, clothes, masks, caps, &c.	36

(To be continued.)

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,611. "Means for and methods of limiting the current on a short circuit." A. M. Taylor. October 24th.

24,616. "Improvements in apparatus for electrically-operating planing machines and the like reciprocating tools." Lancashire Dynamo and Motor Co., Ltd., and G. E. Mason. (Date applied for under Rule 18, May 2nd, 1910. An invention comprised in application No. 10,749, dated May 2nd, 1910.) October 24th.

24,632. "Improved means for fixing electric fuse and the like apparatus.' M. J. Railing and A. J. D. Krause. October 24th.

24,637. "Process for decarbonising metallic-filaments for incandescent electric lamps." Westinghouse Metallfaden Gluhlampenfabrik G.m.b.H. (Application for Patent of Addition to No. 2,983, 1910. Date applied for under Sec. 91 of the Act, November 12th, 1909, being date of application in Austria.) October 24th. (Complete.)

24,638. "Improvements in brushes for dynamo-electric machines." H. Cooch. October 24th.

24,668. "Improvements in thermo-electric circuits." Cambridge Scientific Co., Ltd., and H. Darwin. October 24th. (Complete.)

24,686. "Improved interrupter for ignition machines." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, June 22nd, 1910, being date of application in Germany.) October 24th. (Complete.)

24,687. "Improvements in devices for automatically adjusting the period of ignition in internal-combustion engines." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, October 10th, 1909, being date of application in Germany.) October 24th. (Complete.)

24,688. "Device for guiding electric cables for internal combustion engines." Firm Robert Bosch. (Date applied for under Sec. 91 of the Act, October 12th, 1909, being date of application in Germany.) October 24th. (Complete.)

24,692. "Improvements in variable speed dynamos adapted for train lighting and the like." H. Leitner. October 24th.

24,696. "Improvements in apparatus for the production, strengthening and reception of electrical vibrations." J. Schiessler. October 24th. (Complete.)

24,702. "Improvements in electrically-driven percussive tools." J. Knight. October 24th.

24,729. "Improvements in drying and insulating machines for electrical and other apparatus." A. G. Brown. (A. W. Brown, South Africa.) October 25th.

24,730. "Improvements in current graduating devices for electric lighting." W. Sumner. October 25th.

24,731. "Emergency lamp for cycles and the like." A. van Hoorn. October 25th.

24,808. "Apparatus for stopping and returning to the initial position electrically-operated mechanisms." W. P. Thompson. (Wirth, Beck & Knauss, Germany.) October 25th. (Complete.)

24,810. "Improvements in apparatus for the manufacture of incandescent electric lamps." A. S. Knight. (Date applied for under Sec. 91 of the Act, November 3rd, 1909, being date of application in the United States.) October 25th. (Complete.)

24,818. "Improvements in electric lamp supports." J. Neple. (Date applied for under Sec. 91 of the Act, October 26th 1909, being date of application in France.) October 25th. (Complete.)

24,833. "Improvements in electric motor-starting switches." J. Wright and T. Wallwork. October 26th.

24,851. "Improvements in electrical commutators." Societe "Phi." (Date applied for under Sec. 91 of the Act, August 6th, 1910, being date of application in Belgium.) October 26th. (Complete.)

24,857. "Improvements in and relating to pole protectors." V. Konopinski. October 26th. (Complete.)

24,858. "Automatic signal arm rheostat for regulating any number of electric currents." C. W. Bailey. October 26th.

24,869. "Improvements in electric induction furnaces." H. G. Solomon. October 26th.

24,909. "Waterproof protector for electric lamps." E. Widmer. October 26th. (Complete.)

24,911. "Improvements relating to electric-contact devices for use with moving conductors." W. G. Housekeeper. (Application for Patent of Addition to 7,332/10. Date applied for under Sec. 91 of the Act, November 3rd, 1909, being date of application in the United States.) October 26th. (Complete.)

24,912. "Improvements in or relating electric pump governors." Westinghouse Brake Co., Ltd. (Westinghouse Air Brake Co., United States.)

24,914. "Improvements in or connected with the controlling of automusical and sound-producing instruments by wave-transmitted electricity." T. E. R. Philips. October 27th.

24,916. "Improvements in and relating to variable electric air condensers." B. F. Sobotka. October 27th.

24,935. "Improvements in electrically-controlled governors for steam or other fluid-operated engines." J. W. Huntington. October 27th.

24,994. "Improvements in electric switches." J. H. McLean and W. L. Madgen. October 27th.

24,995. "Circuit suitable for use in connection with automatic telephone systems." Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch et Cie, Germany.) October 27th. (Complete.)

25,008. "Improved construction of coils for electrical purposes." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, May 19th, 1910, being date of application in Germany.) October 27th. (Complete.)

25,012. "Electric railless trackway with above-ground current conductors." H. Sefton-Jones. (Oesterreichische Daimler Motoren Ges., Akt.-Ges., Austria.) October 27th. (Complete.)

25,024. "Means for supporting a lamp or an electric fan in such a way as to be movable in all directions." W. S. G. Baker. October 27th.

25,026. "Improvements in electrical machines." Societe "Phi." (Date applied for under Sec. 91 of the Act, August 6th, 1910, being date of application in Belgium.) October 27th.

25,036. "Improvements in and relating to the cooling of dynamos and the like." G. H. Fawcus. October 28th.

25,069. "Improved system of and apparatus for wiring buildings and the like for the distribution of electricity." L. M. Waterhouse. October 28th.

25,076. "Improvements in electric switches." Spagnoletti, Ltd., and V. E. Joyce. October 28th.

25,092. "Improvements in the manufacture of detachable electrolytic iron deposits." Langbein-Pfanhauser-Werke Akt.-Ges. (Date applied for under Sec. 91 of the Act, November 12th, 1909, being date of application in Germany.) October 28th. (Complete.)

25,167. "Improvements in or relating to continuous-current dynamo machines." Fried. Krupp Akt.-Ges. (Date applied for under Sec. 91 of the Act, January 12th, 1910, being date of application in Germany.) October 29th (Complete.)

25,172. "Improvements in coin-controlled mechanism for governing supply of gas or electricity." A. W. Glover and G. Glover & Co., Ltd.

25,175. "Improved electric process for drying timber." Alcock & Co., Proprietary, Ltd. (Date applied for under Sec. 91 of the Act, November 5th, 1909, being date of application in Australia.) October 29th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Methods of Charging and Discharging Electric Accumulators or Secondary Batteries. A. M. Taylor. 22,518. October 4th.

Electrical Indicating Means for Weighing-Machines. J. Dobson and Henry Pooley & Son, Ltd. 22,539. October 4th.

Method and Apparatus for Collecting Mechanical Energy in the Disturbed Waters of Seas and Lakes by Directly Obtaining a Continuous Rapid Rotary Motion easily Convertible into Electric Energy. E. Bouchard-Praceiq. 22,725. October 5th. (Date applied for under International Convention, April 9th, 1909.)

Indicating and Recording Apparatus for Electric Pyrometers and the like. R. Armour. 22,764. October 6th.

Electric Incandescent Lamps and their Holders. C. Damey. 22,813. October 6th.

Means Applicable for use in Transmitting and Receiving Signals by Wireless Telegraphy or Telephony. British Radio-Telegraph and Telephone Co. and J. G. Balsillie. 22,930. October 7th.

Combination of an Electric Cable Jointer's Handcart and an Electric Cable Drum. Callender's Cable & Construction Co. and T. Petersen. 23,307. October 12th.

Arrangement of a Combined Collector-Ring, Commutator and Switches, for use with a Small Battery to start Petroleum Engines fitted with Magneto-Igniting Apparatus. A. S. J. Chapman. 23,319. October 12th.

Voltage Regulation of Alternating Electric Current Distribution Systems. British Thomson-Houston Co. (General Electric Co.) 23,415. October 13th.

Process of Manufacturing Materials for Metallic Filaments of Electric Incandescent Lamps. E. Ruhstrat. 24,487. October 25th.

Electric Arc Lamps. H. Hirst and A. E. Angold. 24,566. October 26th.

Purification of Liquids by Electricity. R. Hartman. 28,552. December 7th.

Telephone Mouthpieces. P. B. Clarke. 30,352. December 29th.

1910.

Dynamos and Motors. Crompton & Co., J. C. Macfarlane and H. Burge. 824. January 12th.

Process for Decarbonising Metallic Filaments for Incandescent Electric Lamps. Westinghouse Metallfaden-Gluhlampenfabrik Ges. 2,983. February 7th. (Date applied for under International Convention, February 19th, 1909.)

Manufacture of Tungsten Filaments for Incandescent Electric Lamps. Westinghouse Metallfaden-Gluhlampenfabrik Ges. 3,610. February 14th. (Date applied for under International Convention, February 15th, 1909.)

Electric Lamp. E. Urbain, A. Feige and C. Scal. 4,098. February 18th.

Ventilation of Dynamo-Electric Machines. Siemens Bros. Dynamo Works, E. O. Kieffer and K. W. Schaeffer. 5,117. March 1st.

Arc Lamps. T. L. Carbone. 5,561. March 5th.

Machines for the Manufacture of Flexible Metallic Tubes or for Armouring Insulated Electric and other Cables. W. A. Marshall. 6,706. March 17th.

System for use in Long-Distance Telephony. A. Petersen and G. Sem. 6,895. March 18th. (Date applied for under International Convention, March 25th, 1909.)

Devices for Automatically Controlling the Ignition Period in Magneto-Electric Ignition Apparatus. W. P. Thompson. (Ernst Eisemann and Co. Ges.) 9,468. April 19th.